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Manual of Ohio Weeds

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OHIO
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Wooster, Ohio

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FOREWORD

The control of weeds is one of the most difficult and expensive operations in Agriculture; it is also one of the oldest problems. A continuous fight has been waged on weeds since the earliest records of crop culture.

The cost of this fight is enormous. The actual loss due to weeds is difficult to estimate; one estimate claims 3 billion dollars annually. The United States Department of Agriculture, Office of Farm Management, estimates losses of corn at 10 per cent, spring grains at 12 to 15 per cent, potatoes at 6 to 10 per cent, and pastures at 10 to 25 per cent. The average annual loss per farm in Indiana was estimated in 1920 at $210. The 1927 estimate of Wisconsin was $244 per farm. These losses are brought about in the field through competition, extra labor in culture and harvesting, through loss in feeding value of crops, in dockage, and in many other ways.

Since the control is difficult and expensive and the losses are so tremendous, it would seem logical to place this problem as a major project both from a research and extension point of view. Better methods of weed eradication are needed, and, until they are found, hard labor with the hoe and definite, sound cultural practices are the only solutions.

While the control of weeds involves all practices in agriculture, one of the first fundamentals to consider is the identification of the plants. This bulletin will furnish a ready text for such a study. It is hoped that free use will be made of it in schools where botany and agriculture are taught.

One hundred and five of the illustrations contained in this Manual were made from drawings prepared by Mrs. Margaret E. Runnels. One hundred of these are from original drawings, four are copied from and accredited to Beal's *Michigan Weeds*, and one from Clark and Fletcher's *Farm Weeds of Canada*. The remaining three cuts were prepared from illustrations in Selby's *A Second Ohio Weed Manual*.

Wooster, 1931 H. C. Young

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MANUAL OF OHIO WEEDS

H. A. RUNNELS AND J. H. SCHAFFNER

INTRODUCTION

"Thorns also and thistles shall it bring forth to thee."

Ever since man began to till the soil he has had to do battle with the weeds, and the weed problem is still of fundamental importance to every farmer, for this problem of the weeds is still far from being solved.

All animal life upon the earth is dependent on green plants for existence; for the organic food on which man and animal subsist comes primarily, either directly or indirectly, from the green plant. The food is manufactured in the green parts, especially the leaves, through the agency of the green coloring matter, called chlorophyll, and light. Thus, every green plant tissue is a food factory. The farmer wishes to grow certain plants for special purposes, and the most important purpose, of course, is food. In nature, as well as in human society, one individual may contend for space, soil, water, and light with another, or the individuals of one species may so contend with another species. Plants have different properties and potentialities, and some of the aggressive ones are apt to interfere with our operations as husbandmen. Such plants we usually think of as weeds.

A weed has thus been defined as a plant out of place or a plant which grows where it is not wanted. From the standpoint of this broad definition, any plant may some time in some place be considered a weed. Even the very species we cultivate, as for example rye or oats, are often injurious to the succeeding crop and require special effort to get rid of them. But, ordinarily, we think of weeds as being those wild plants which are very aggressive in spreading into cultivated fields, meadows, and pastures and coming into competition with the plants we wish to grow in the given place. The weeds that are the most troublesome are species which have a life cycle that corresponds to the life history of the cultivated plants, which have a vigorous constitution and a tenacious hold on life, which are well adapted to cultivated soils, grasslands, or pastures, and which have abundant reproductive powers, either through seed production or vegetative propagation or both. As intimated above, weeds have a very vigorous constitution and are well adapted to grow in the situations in which they are injurious; otherwise, they would not be weeds.

Weeds are injurious in many special ways, primarily because of choking out and overshading the plants we wish to grow. They also extract an enormous amount of water from the soil and, along with it, plant nutrients which thus cannot be taken up by the crop plants. There is often direct competition between the roots of the weeds and those of the crop plants, especially when they spread out in the same layer of soil. Weeds not only deprive other plants of space, light, moisture, and soil nutrients, but they may also harbor injurious parasites, especially insects and parasitic fungi. Many of our weeds are alternative hosts for fungi parasitic on crop plants. They also often interfere with harvesting of the crop, as, for example, the presence of morning-glories, which frequently interfere with the proper drying of hay and grain in the shock. Weeds, when eaten by cows, may also render milk very offensive, as in the case of certain ragweed pollens, field garlic, or various wild onions. Bulblets of field garlic and various seed may also be injurious when mixed with grains used for flour. Some of our weeds are among the worst of the hay-fever-producing plants, and some are especially poisonous to live stock, including cattle, horses, sheep, and swine.

On the other hand, some weeds make useful feed and fodder for animals and some are used for human food and for medicine. When plowed under properly some make valuable green manure. Others add nitrogen to the soil by means of their root tubercles. In abandoned fields, they serve as a cover crop and reduce erosion while their roots help to loosen up the soil and in other ways assist in the succession to more desirable plant associations.

Some of our worst weeds are very beautiful and appeal to our esthetic nature. What is a more pleasing sight than a patch of morning-glories in the morning sunshine? The very name, morning-glory, proclaims the sentiment aroused in our ancestors who first invented the name. The common barberry is a very attractive shrub, and many people resent the demand to have it eradicated from their gardens; yet it is a very pernicious plant from the standpoint of food production, simply because it happens to be a suitable host for the fungus that causes the destructive black stem rust of wheat. Thus, both these plants and many others should be destroyed as completely as possible, for, although man does not live by bread alone, there are scores of plants which are perfectly harmless that can take their place as ministers to our esthetic needs.

In any intelligent effort to get rid of weeds, the first thing necessary is to recognize the different kinds. The scientific and common specific names which are applied to them must be learned

and when this is accomplished a proper effort at control or eradication can be made. Every progressive farmer, gardener, and orchardist should have some knowledge of botany, even if he has only a common school education.

The study of weeds and other plants is greatly facilitated by the use of an ordinary hand lens, which can be bought at a nominal price. The weeds on the home farm and immediate vicinity may be studied by means of the illustrations and brief descriptions given in this manual and then traced through the key, or, if one knows some botany, the key can be used first and the illustrations employed to confirm the identification.

"I went by the field of the slothful,
And by the vineyard of the man void of understanding;
And, lo, it was all grown over with thorns,
The face thereof was covered with nettles,
And the stone wall thereof was broken down."

PROVERBS.

"A man of words and not of deeds
Is like a garden full of weeds."

DIRECTIONS FOR SENDING PLANTS FOR IDENTIFICATION

Each year a considerable number of plants is received for identification by the Ohio Agricultural Experiment Station. In the case of weeds they accompany inquiries relative to methods of control. The Station is glad to render this service to all residents of the State. However, in many cases the specimens received are in such poor condition or are so fragmentary that a correct identification is difficult or impossible. Lack of a complete specimen should not deter the correspondent from sending in a plant, but it is well to keep in mind the following suggestions when selecting and preparing a specimen for mailing:

Send the complete plant whenever possible—roots, stems, and leaves, as well as flowers, fruits, and seeds if there are any. The commoner weeds can often be identified by their vegetative characters alone, but new weeds and other plants are frequently identifiable only when the floral parts are present. The grasses are especially difficult to identify unless the heads are fully formed. Specimens of woody plants may consist of a fair-sized twig with leaves.

The plant should be wrapped in several thicknesses of moist newspaper, then in an oiled paper, such as is used for bread, and finally in dry wrapping paper. Large specimens may be cut into convenient lengths before wrapping. In case the plant is not mailed as soon as collected, it should be pressed flat between sheets of blotting paper and dried. Dried specimens are best packed between stiff sheets of cardboard for mailing. When several plants are submitted, each specimen should bear a tag numbered to correspond to a duplicate set of specimens kept by the person sending them. A description of the place and habit of growth, as well as mention of the locality and county in which the plant was collected, will be helpful, if sent in an accompanying letter.

The package should bear the name and address of the sender. Address package and correspondence to Ohio Agricultural Experiment Station, Wooster, Ohio.

It should be added that the Station does not encourage pupils of grade and high schools to submit for identification miscellaneous collections of plants that have been prepared in connection with a study of the local flora. Such collections should be identified by the student, insofar as possible, as a part of his class work, using this and other manuals for the purpose. The perusal of a list of plants identified by another person can be of only minor value to the student.

KEY TO THE SPECIES OF OHIO WEEDS BASED ON VEGETATIVE CHARACTERS

The following key has been devised in order that our common weeds may be identified more or less definitely before the flowers are developed. The main difficulty will, of course, be to know whether a given plant is actually one of the weeds treated in the bulletin. Nevertheless, it will frequently be found useful when determinations are to be made without the aid of flowers. In the grasses, the panicle is necessary, but the details of the spikelets are not. The dicotyl rosettes are treated in a separate section and include not only the scapose plants with typical rosettes but also the more typical rosettes of annual and biennial weeds even though they may produce leafy stems later in the season.

For definite determinations at flowering time, Schaffner's *Field Manual of the Flora of Ohio and Adjacent Territory*, published by R. G. Adams & Co., Columbus, Ohio, will be found convenient.

1. Leaves parallel-veined; closed vascular bundles scattered through the stem; flowers in threes. 2.
1. Leaves netted-veined or without developed leaves; if parallel-ribbed, then with open vascular bundles in a circle around the central pith; flowers mostly in fives or fours, but sometimes in twos or threes. 26.

— *2* — *Monocotyls*

2. Leaves hollow, linear, with onion odor; plants with bulbs and bulblets. **Allium vineale.**
2. Leaves solid. 3.
3. Leaves fleshy, from a coated bulb. **Ornithogalum umbellatum.**
3. Leaves not fleshy; plants not bulbous. 4.
4. Stem 3-angled and leaves in 3 spirals. **Cyperus esculentus.**
4. Stems round or flattened, not 3-angled; leaves 2-ranked. 5.
5. Spikelets in a prickly bur, the burs forming a spike; stems finally forming a mat. **Cenchrus pauciflorus.**
5. Spikelets not in a prickly bur. 6.
6. Spikelets in definite rows on both sides of the axis or on one side only. 7.
6. Spikelets scattered on panicles or in spikes, not in definite rows. 13.
7. Inflorescence a simple terminal spike with the spikelets in 2 opposite rows. 8.
7. Inflorescence branched. 9.
8. Awns of the spikelets short or lacking; perennial by runners. **Agropyron repens.**
8. Awns very long and numerous; annuals. **Hordeum jubatum.**
9. Spikelets on one side of more or less definitely digitate branches of the inflorescence. 10.
9. Spikelets in a panicle, or on 2 or 3 digitate branches with prominent white hairs and in a sheath. 12.
10. Spikelets several-flowered. **Eleusine indica.**
10. Spikelets 1-flowered. 11.
11. Leaves, and especially the sheaths, hairy. **Syntherisma sanguinale.**
11. Leaves smooth. **Syntherisma ischaemum.**
12. Spikelets on 2-3 delicate, very hairy branches of the inflorescence, at first enclosed in a sheath, perennial. **Andropogon virginicus.**
12. Spikelets on an ample panicle, annual. **Echinochloa crus-galli.**
13. Spikelets with 2 to several flowers. 14.

13. Spikelets usually 1-flowered, rarely with a second staminate flower. 20.
14. Grass with a strong odor; spikelets small but many-flowered. **Eragrostis major.**
14. Grass without a strong odor; spikelets large, with several flowers or with only 2 flowers. 15.
15. Lemma with a twisted and bent awn. 16.
15. Lemma with a straight awn or unawned. 17.
16. Panicle ample; awn from the back of the lemma. **Avena fatua.**
16. Panicle small, rather contracted; awn from between the 2 teeth at the tip of the lemma. **Danthonia spicata.**
17. Lower empty glume 3-nerved, the upper one 5-9-nerved. 18.
17. Lower empty glume 1-nerved, the upper one 3-nerved; soft-pubescent. **Bromus tectorum.**
18. Lemma hairy, short-awned. **Bromus hordeaceus.**
18. Lemma smooth or minutely roughened. 19.
19. Leaf sheaths smooth or nearly so; lemmas with very short awns. **Bromus secalinus.**
19. Leaf sheaths softly and densely hairy; lemmas with medium-length awns. **Bromus racemosus.**
20. Panicle ample and open. 21.
20. Panicle contracted or spike-like, with bristles at the base of the spikelets. 23.
21. Stem solid; spikelets awned; empty glumes indurated; flowering glumes hyaline; sheaths smooth. **Holcus halapensis.**
21. Stem hollow; spikelets not awned; empty glumes membranous; flowering glumes indurated. 22.
22. Leaves smooth. **Panicum dichotomiflorum.**
22. Leaves hairy. **Panicum capillare.**
23. Bristles at the base of the spikelets downwardly barbed. **Chaetochloa verticillata.**
23. Bristles upwardly barbed. 24.
24. Bristles mostly 1-3; inflorescence paniculate. 25.
24. Bristles 5-16; inflorescence racemose. **Chaetochloa glauca.**
25. Bristles usually purple or yellowish-purple; inflorescence 4-9 inches long. **Chaetochloa italica.**
25. Bristles green; inflorescence 1-3 inches long. **Chaetochloa viridis.**

— *26* — *Dicotyls*

26. Plants without chlorophyll, parasitic. 27.
26. Plants green, not parasitic. 31.
27. Root parasites, not twining. **Orobanche ludoviciana.**
27. Stem parasites, twining, leafless. Dodders. 28.
28. Stigmas slender; corolla-scales crenulate; capsule opening by a lid. 29.
28. Stigmas capitate; corolla-scales fringed; capsule indehiscent. 30.
29. Corolla-scales crenulate above, not incurved; flowers yellowish. **Cuscuta epilinum.**
29. Corolla-scales crenulate all around, strongly incurved; flowers in small, dense, pinkish clusters, the corolla whitish or pinkish. **Cuscuta epithymum.**
30. Flowers very nearly sessile; corolla persistent at the base of the capsule; corolla-scales ovate, fringed all around. **Cuscuta arvensis.**
30. Flowers distinctly pedicelled; corolla enclosing or capping the capsule, at length deciduous; corolla-scales long, fringed mainly above. **Cuscuta gronovii.**

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31. Plants with woody stems. 32.
31. Plants herbaceous. 38.
32. Plants with thorns, prickles, or spines. 33.
32. Plants without thorns, prickles, or spines; leaves trifoliate; climbing by rootlets; poisonous to the touch. **Toxicodendron radicans.**
33. Leaves simple. 34.
33. Leaves compound. 36.
34. Plants with simple or branched spines representing modified leaves. **Berberis vulgaris.**
34. Plants with thorns. 35.
35. Large or small trees; the leaves with stipules or stipular scars. **Crataegus** sp.
35. Shrubs with slender stems; the leaves without stipules. **Lycium halimifolium.**
36. Leaves pinnate, the end leaflet not much larger than the lateral leaflets; petiole deciduous close to the bark. 37.

36. Leaves with 3-5 leaflets, the end leaflet larger; base of petiole persistent. **Rubus alleghaniensis.**
37. Rachis of the leaves glandular; leaflets densely glandular-pubescent and resinous beneath, very aromatic. **Rosa rubiginosa.**
37. Rachis and leaflets not glandular. **Rosa virginiana.**

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38. Plants with aerial stems. 39.
38. Plants scapose but with distinct rosettes; including also all typical juvenile, annual and biennial rosettes. 241.
39. Plants with thorns, prickles, or spines on the vegetative parts, or with spinose serrations or spinose lobes on the leaves. 40.
39. Plants without thorns, prickles, or spines on the vegetative parts, though they may have them on the flowers or inflorescence. 54.
40. Leaves alternate. 41.
40. Leaves opposite; with numerous, short prickles on the stems, peduncles, and midribs of the leaves. **Dipsacus sylvestris.**
41. Plants with stipular spines, some or all of the leaves reduced to spines, with special branched spines not on the leaves, or with a spine-like tubercle at the base of the petiole. 42.
41. Plants having leaves with numerous prickles or spiny lobes or teeth. 45.
42. Leaves not with a pair of stipular spines; spines or prickles not 3-pronged. 43.
42. Leaves with a pair of long, stipular spines; or with 3-pronged, yellow spines in the leaf axils. 44.
43. Later leaves reduced to spiny bracts. **Salsola pestifer.**
43. Leaves with a spine-like tubercle at the base of the petiole. **Sida spinosa.**
44. With 3-pronged, yellow spines in the leaf axils. **Xanthium spinosum.**
44. With a pair of long, stipular spines at the base of the petiole. **Amaranthus spinosus.**
45. Plant stellate-pubescent; margins of the leaves neither spinose nor prickly-toothed; stems covered with prickles; leaves distinctly petioled. 46.
45. Plant not stellate-pubescent; margins of the leaves spinose or prickly-toothed; stem not with prickles, or, if so, the prickles on wing margins, or the leaves cordate-clasping, or the leaves with wing-margined petioles. 47.
46. Perennials; leaves repand, lobed, or pinnatifid. **Solanum carolinense.**
46. Annuals; leaves pinnately 5-7-lobed or 1-2-pinnatifid. **Solanum rostratum.**
47. Sap not milky; leaves tomentose on one or both surfaces, or, if nearly glabrous, then the stems striate. 48.
47. Sap milky; leaves glabrous or glaucous, or, if pubescent, not tomentose. 51.
48. Leaves more or less tomentose; stem wing-angled, the wings spiny. 49.
48. Leaves green on both sides when mature, somewhat pubescent or tomentose beneath when young; stems not winged, striate. 50.
49. Leaves dark green, upper surface strigose-pubescent or hispid, the lower brown-tomentose; receptacle of head bristly. **Cirsium lanceolatum.**
49. Leaves white-tomentose all over; receptacle flat not bristly. **Onopordon acanthium.**
50. Biennial; flowers all perfect and fertile. **Cirsium muticum.**
50. Perennial by horizontal roots, forming patches; flowers diecious. **Cirsium arvense.**
51. Stem leaves taking a profile position, the midrib prickly-hirsute; stem prickly-hirsute at the base. **Lactuca virosa.**
51. Stem leaves not taking a vertical position, the midribs glabrous or at most slightly pubescent; stem not bristly-hirsute at the base. 52.
52. Auricles of the leaves rounded; involucre glabrous, heads not over ⅔ in. high; annual. **Sonchus asper.**
52. Auricles of the leaves acute or the lower stem leaves with short petioles. 53.
53. Involucre and peduncles glandular-pubescent; heads nearly 1 in. high; perennial with deep creeping rhizome. **Sonchus arvensis.**
53. Involucre and peduncles glabrous, or, if hairy, not glandular; heads not over ⅔ in. high; annual. **Sonchus oleraceus.**

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54. Leaves opposite or whorled, at least the lower ones. 55.
54. Leaves alternate. 109.

55. Leaves digitately compound, mostly with 3-11 leaflets, finely resinous-speckled. **Cannabis sativa.**
55. Leaves not digitately compound. 56.
56. Leaves with punctate glands, resin dots at least on the under side, or glandular scales; sap not milky. 57.
56. Leaves without punctate glands, resin dots, or glandular scales. 71.
57. Leaves not pinnately dissected. 58.
57. Leaves pinnately or bipinnately dissected, with oval, reddish or orange glands; strong-scented. **Boebera papposa.**
58. Leaves entire. 59.
58. Leaves serrate, crenate, incised, or deeply lobed. 60.
59. Leaves sessile; plant erect. **Hypericum perforatum.**
59. Leaves petioled; plant creeping. **Lysimachia nummularia.**
60. Leaves whorled, with petioles. **Eupatorium purpureum.**
60. Leaves opposite, or, if whorled, then without petioles. 61.
61. Leaves nearly all perfoliate, large, 4-8 in. long. **Eupatorium perfoliatum.**
61. Leaves not perfoliate or, if so, much smaller. 62.
62. Leaves very woolly, especially below, broadly ovate to nearly orbicular, petioled; stems woolly. **Marrubium vulgare.**
62. Leaves not woolly, but glabrous, canescent, or hairy. 63.
63. Stems creeping, with crenate, orbicular or reniform, petioled leaves; with pungent odor. **Glecoma hederacea.**
63. Stems erect or merely decumbent, not creeping. 64.
64. Leaves deeply 3-5-palmately-lobed or cleft, the divisions incised-toothed, very veiny beneath, large- and long-petioled, cordate or truncate at the base. **Leonurus cardiaca.**
64. Leaves not as above. 65.
65. Leaves with a cordate base. 66.
65. Leaves not cordate at the base. 67.
66. Plant densely canescent; leaves acute at the apex, coarsely crenate-dentate; odorous. **Nepeta cataria.**
66. Plant sparingly pubescent or nearly glabrous, not canescent; leaves rounded or with short-pointed tips; not odorous. **Lamium amplexicaule.**
67. Plant not strongly aromatic or pungent. 68.
67. Plant strongly aromatic or pungent. 69.
68. Leaves merely sharply dentate. **Lycopus virginicus.**
68. Leaves pinnatifid or deeply incised. **Lycopus americanus.**
69. Stems soft-pubescent. **Hedeoma pulegioides.**
69. Stems glabrous. 70.
70. Leaves sessile or nearly so. **Mentha spicata.**
70. Leaves petioled. **Mentha piperita.**

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71. Leaves deeply lobed, dissected, or compound. 72.
71. Leaves serrate, crenate, dentate, or entire. 79.
72. Leaves with stipules, palmately cleft. **Geranium carolinianum.**
72. Leaves without stipules. 73.
73. Leaves lobed, the lobes large and broad; stem ridged. **Ambrosia trifida.**
73. Leaves much dissected or appearing pinnately compound or divided. 74.
74. Leaves cut into narrow lobes. 75.
74. Leaves with rather broad pinnate segments or rather broad leaflets. 76.
75. Perennial; leaves thick, 1-2 times pinnatifid; pubescence strigose or hispid. **Ambrosia psilostachya.**
75. Annual; leaves thin, 2-3 times pinnatifid, puberulent or hirsute. **Ambrosia elatior.**
76. Leaves pinnately 3-5-divided with oblong-lanceolate divisions; stems not quadrangular. 77.
76. Leaves 1-3 times pinnately dissected into 5-7 lanceolate or linear-lanceolate lobes; stems quadrangular or obscurely quadrangular. 78.
77. Terminal leaflet long-stalked. **Bidens frondosa.**
77. Leaflets all short-stalked. **Bidens vulgata.**
78. Stem quadrangular; ray-flowers rudimentary or short. **Bidens bipinnata.**
78. Stem slightly quadrangular; ray-flowers large and conspicuous. **Bidens trichosperma.**
79. Leaves verticillate, entire; prostrate annuals. **Mollugo verticillata.**

79. Leaves opposite. 80.
80. Leaves entire. 81.
80. Leaves dentate, serrate, or crenate. 91.
81. Sap milky. 82.
81. Sap not milky. 85.
82. Plant evergreen, low creeping. **Vinca minor.**
82. Plant not evergreen, erect perennials. 83.
83. Plant glabrous or nearly so, or the leaves somewhat pubescent beneath, 2-5 in. long. 84.
83. Plant finely pubescent; leaves oblong or ovate, 4-9 in. long. **Asclepias syriaca.**
84. Leaves ovate or oval; corolla campanulate. **Apocynum androsaemifolium.**
84. Leaves oblong to ovate-lanceolate; corolla urceolate. **Apocynum cannabinum.**
85. Leaves with very short petioles, very fleshy, narrowly obovate, glabrous. **Portulaca oleracea.**
85. Leaves narrowed into petioles, not fleshy. 86.
85. Leaves sessile, not fleshy. 87.
86. Stems with a longitudinal line of hairs. **Alsine media.**
86. Stems glabrous. **Isnardia palustris.**
87. Plant viscid-pubescent. 88.
87. Plant glabrous, or if pubescent not viscid. 90.
88. Leaves oblong, ovate, or obovate, rounded to acute at the apex. 89.
88. Leaves ovate-lanceolate, acute or acuminate. **Silene noctiflora.**
89. Leaves ovate or obovate; pedicels not longer than the sepals; flowers glomerate. **Cerastium viscosum.**
89. Leaves oblong; pedicels, at length, longer than the sepals; flowers cymose. **Cerastium vulgatum.**
90. Plants densely pubescent, not glutinous; annual. **Agrostemma githago.**
90. Plants pubescent, prominently glutinous at or below the nodes; annual. **Silene antirrhina.**
90. Plants glabrous; leaves 3-ribbed; perennial. **Saponaria officinalis.**

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91. Plants with milky sap. 92.
91. Plants not with milky sap. 94.
92. Leaves large, long-petioled, not inequilateral, dentate. **Poinsettia dentata.**
92. Leaves small, short-petioled or sessile, inequilateral at the base, serrate or nearly entire. 93.
93. Plants erect or ascending, the tips nodding; leaves ½-1¼ in. long, folding in pairs at night. **Chamaesyce preslii.**
93. Plants usually prostrate and forming mats; leaves ¼-¾ in. long. **Chamaesyce maculata.**
94. Leaves distinctly 3-5-nerved or with 2-4 prominent side-ribs from the base or, if not decidedly so, then not glabrous. 95.
94. Leaves pinnately veined, petioled, sharply and coarsely serrate; glabrous annual. **Bidens connata.**
94. Leaves pinnately veined, the upper sessile, sharply denticulate; glabrous perennial, but the inflorescence glandular-pubescent. **Pentstemon digitalis.**
95. Leaves sessile or with winged petioles, only the lowest leaves, if any, with a normal petiole. 96.
95. Leaves distinctly petioled, except the very uppermost. 103.
96. Stem obtusely 4-angled; tall plants densely soft-pubescent. **Verbena stricta.**
96. Stem round or somewhat angled, but not 4-angled. 97.
97. Plants tall, erect, and robust, with large leaves. 98.
97. Plants small, low or creeping, with small leaves. 99.
98. Rhizomes slender; leaves sessile, serrulate. **Helianthus doronicoides.**
98. Rhizomes thickened and fleshy; leaves narrowed at the base, longer petioled, coarsely serrate. **Helianthus tuberosus.**
99. Flowers racemose in the axils of the leaves, pale blue; pubescent perennial. **Veronica officinalis.**
99. Flowers in terminal spikes or racemes, or solitary in the axils. 100.
100. Flowers in terminal spikes or racemes, blue or white; lower leaves petioled; leaves oblong to ovate, puberulent to glabrous; perennial. **Veronica serpyllifolia.**

100. Flowers solitary in the axils. 101.
101. Peduncles shorter than the leaves. 102.
101. Peduncles as long as the leaves or longer; pubescent annual; flowers blue. **Veronica agrestis.**
102. Plants erect, glabrous or glandular; flowers nearly white; annual. **Veronica peregrina.**
102. Plants diffuse, pubescent; flowers blue or nearly white; annual. **Veronica arvensis.**

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103. Plants tall, coarse, with large, broadly ovate, petioled leaves; annual. **Helianthus annuus.**
103. Plants medium sized and slender. 104.
104. Plants with stipules and stinging hairs. 105.
104. Plants without stipules, hairs not stinging or the plant glabrous. 106.
105. Petiole more than half as long as the leaf breadth; leaves lanceolate to ovate-lanceolate, nearly glabrous. **Urtica gracilis.**
105. Petiole less than half as long as the leaf breadth; leaves ovate, pubescent. **Urtica dioica.**
106. Stem 4-sided. 107.
106. Stem not 4-sided. 108.
107. Leaves usually rounded at the base; corolla white or blue. **Verbena urticaefolia.**
107. Leaves narrowed at the base; corolla blue. **Verbena hastata.**
107. Leaves cordate at the base; plant aromatic, soft-pubescent; stem hollow. **Nepeta cataria.**
108. Perennial; leaves truncate or cordate at the base, ovate, acuminate at the apex, thin, glabrous or somewhat villous and viscid. **Eupatorium urticaefolium.**
108. Annual; leaves obtuse at the base, ovate, acute at the apex, appressed-pubescent or hirsute. **Galinsoga parviflora.**
108. Annual; leaves hastate, somewhat white-scurfy, glabrous. **Atriplex hastata.**

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109. Leaves with peculiar, membranous, sheathing stipules or ocreae. 110.
109. Leaves with or without stipules; when present, not forming sheathing ocreae, although the petiole bases may be sheathing. 120.
110. Leaves cordate-sagittate or hastate. 111.
110. Leaves not cordate-sagittate or hastate at the base. 112.
111. Stems twining or trailing; annual; ocreae oblique, more or less open on the side facing the leaf. **Tiniaria convolvulus.**
111. Stem erect, low; perennial; ocreae with 2 long lobes. **Rumex acetosella.**
112. Leaf-blades jointed at the base; ocreae 2-lobed, becoming lacerate. 113.
112. Leaf-blades not jointed at the base. 114.
113. Flowers 1-2 together in the axils; sepals greenish-yellow or yellowish; plant yellowish-green. **Polygonum erectum.**
113. Flowers in clusters of 1-5; sepals green except the white, pink, or purplish border; plant bluish-green. **Polygonum aviculare.**
114. Ocreae fringed with bristles. 115.
114. Ocreae not fringed with bristles. 117.
115. Ocreae inconspicuously fringed. **Persicaria persicaria.**
115. Ocreae conspicuously fringed. 116.
116. Ocreae strigose, cylindric, fringed with slender bristles; perennial; racemes erect. **Persicaria hydropiperoides.**
116. Ocreae glabrous or slightly pubescent, cylindric, usually swollen at the base, fringed with short bristles; annual; racemes drooping. **Persicaria hydropiper.**
117. Stems not grooved; racemes simple and usually spike-like, sometimes panicled. 118.
117. Stems several-grooved; panicles compound. 119.
118. Leaves lanceolate, acuminate at the apex; racemes erect. **Persicaria pennsylvanica.**
118. Leaves oblong-lanceolate, attenuate-acuminate at the apex; racemes drooping. **Persicaria lapathifolia.**
119. Leaves oblong-lanceolate, cordate or rounded at the base, little or not at all crisped, somewhat undulate. **Rumex obtusifolius.**
119. Leaves narrowly oblong or lanceolate, prominently crisped and wavy-margined. **Rumex crispus.**

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120. Leaves digitately trifoliate, the leaflets entire, obcordate; sap sour. 121.
120. Leaves not digitately trifoliate or, if so, the leaflets not entire. 123.
121. Leaflets with brown margins; petioles villous. **Oxalis grandis.**
121. Leaflets green, not with brown margins. 122.
122. Stems not creeping, usually villous; petiole bases scarcely dilated; pedicels loosely pubescent. **Oxalis cymosa.**
122. Stems not creeping, appressed-pubescent; petiole bases narrowly dilated; pedicels appressed-pubescent. **Oxalis stricta.**
122. Stems creeping and rooting freely, sparingly pubescent or nearly glabrous. **Oxalis corniculata.**
123. Leaves with stipules, these sometimes deciduous, leaving a stipular scar. 124.
123. Leaves without stipules but sometimes with sheathing or clasping bases. 138.
124. Leaves with tendrils. 125.
124. Leaves without tendrils. 126.
125. Perennial; leaflets 18-24, linear to linear-oblong. **Vicia cracca.**
125. Annual; leaflets 12-14, oblong to linear-oblong. **Vicia hirsuta.**
126. Leaves compound. 127.
126. Leaves deeply cleft, lobed, serrate, dentate, or entire. 133.
127. Leaves pinnately compound with several leaflets. 128.
127. Leaves trifoliate or digitately 3-5-foliate. 129.
128. Main leaflets 9-17, closely or softly pubescent beneath. **Agrimonia parviflora.**
128. Main leaflets mostly 7, lower surface rarely pubescent. **Agrimonia gryposepala.**
129. Leaves 3-5-foliate; stem extensively creeping. **Potentilla canadensis.**
129. Leaves 3-foliate; stems erect. 130.
130. Leaflets deeply and coarsely toothed; stem stout, hirsute. **Potentilla monspeliensis.**
130. Leaflets denticulate. 131.
131. Leaflets oblong-ovate to oblanceolate. 132.
131. Leaflets obovate to nearly orbicular. **Medicago lupulina.**
132. Leaflets emarginate, truncate, or rounded at the apex; flowers white. **Melilotus alba.**
132. Leaflets rounded at the apex, not truncate. **Melilotus officinalis.**
133. Leaves deeply cleft. 134.
133. Leaves not cleft, at most slightly lobed. 135.
134. Leaves reniform-orbicular in outline, deeply cleft into 5-9 toothed or lobed segments; calyx not inflated. **Geranium carolinianum.**
134. Leaves ovate or orbicular in outline, pedately 3-7-lobed or divided, the lobes dentate-crenate or cleft, the middle one longer; calyx inflated and membranous. **Hibiscus trionum.**
135. Leaves prominently cordate at the base. 136.
135. Leaves rounded or acute at the base. 137.
136. Stems procumbent or spreading; leaves dentate-crenate, slightly lobed, obtuse. **Malva rotundifolia.**
136. Stems erect, tall; leaves nearly entire, acuminate. **Abutilon abutilon.**
137. Petioles of the larger leaves with a spine-like process at the base; leaves crenate-dentate. **Sida spinosa.**
137. Petioles without a spine-like process at the base; leaves coarsely serrate. **Acalypha virginica.**

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138. Plants twining or trailing; leaves petioled, with a hastate, cordate, or sagittate base; sap milky. 139.
138. Plants erect or prostrate, but not twining or trailing; leaves, if sagittate, clasping the stem. 141.
139. Leaves deeply 3-lobed, with a cordate base; stem and leaves hairy. **Ipomoea hederacea.**
139. Leaves not lobed, at most hastate. 140.
140. Leaves triangular in outline, hastate, acute, or acuminate; calyx with 2 bracts. **Convolvulus sepium.**
140. Leaves ovate or oblong, obtusish and mucronulate or acutish at the apex, sagittate or somewhat hastate; calyx not bracted. **Convolvulus arvensis.**
140. Leaves cordate, with slender petioles, not hastate nor sagittate. **Ipomoea purpurea.**

141. Sap milky, sometimes discolored. 142.
141. Sap not milky. 147.
142. Leaves entire, linear. **Tithymalus cyparissias.**
142. Leaves not entire or, if so, not linear. 143.
143. Leaves auricled or cordate or sagittate-clasping. 144.
143. Leaves not clasping, petioled, sometimes with a sagittate base, or merely sessile. 146.
144. Leaves with a sagittate base, usually with distant, large, tooth-like lobes. **Lactuca saligna.**
144. Leaves with a cordate or auricled, clasping base. 145.
145. Leaves toothed, sometimes entire. **Cichorium intybus.**
145. Leaves sinuate-pinnatifid. **Lactuca canadensis.**
146. Leaves pinnately divided. **Papaver dubium.**
146. Leaves dentate; ovulary trilocular. **Poinsettia dentata.**
147. Leaves with a sagittate or cordate-clasping base. 148.
147. Leaves sessile or petioled, not with a sagittate or cordate base; but they may be sagittate on a petiole, or sheathing by the dilation of the petiole base, or decurrent. 157.
148. Leaves orbicular, covering the retrorsely-hispid stem. **Specularia perfoliata.**
148. Leaves longer. 149.
149. Leaves pubescent. 150.
149. Leaves glabrous. 154.
150. Stem leaves twisted into the vertical or profile position; plants perennial by stolons and offsets; leaves dentate, with long, soft hairs. **Erigeron philadelphicus.**
150. Stem leaves not taking the profile position; plants annual or biennial. 151.
151. Leaves entire, with soft, short hairs, the basal ones long-petioled. **Cynoglossum officinale.**
151. Leaves, at least the lower, more or less toothed or lobed, or if nearly entire then the pubescence of forked hairs. 152.
152. Pubescence of forked or stellate hairs; plant not glandular-viscid. 153.
152. Pubescence not of forked hairs; but the hairs often in twos, lower surface of leaf especially granular-viscid. **Lepidium campestre.**
153. Basal leaves entire or toothed; plant nearly glabrous; flowers yellow. **Camelina sativa.**
153. Basal leaves usually more or less lobed or pinnatifid; flowers white. **Bursa bursa-pastoris.**
154. Basal leaves entire or toothed. 155.
154. Basal leaves pinnatifid; stems angled. 156.
155. Stem leaves sparingly dentate, oblong or lanceolate. **Thlaspi arvense.**
155. Stem leaves entire, elliptic or ovate. **Conringia orientalis.**
156. Leaf segments 1-4 pairs. **Barbarea barbarea.**
156. Leaf segments 4-8 pairs. **Barbarea verna.**

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157. Leaves (at least some of them) compound, dissected, lobed, parted or divided. 158.
157. Leaves simple, entire, variously toothed or angled, or slightly lobed; sometimes hastate or sagittate at the base. 192.
158. Stem hollow; petioles somewhat dilated below. 159.
158. Stem solid. 167.
159. Basal leaves simple, the stem leaves palmately cut into 3-5 divisions, glabrous. **Ranunculus abortivus.**
159. Basal and stem leaves 3-parted, the divisions again lobed or divided or the basal leaves pinnately compound or decompound. 160.
160. Basal and stem leaves 3-parted, the divisions again lobed or divided. 161.
160. Basal leaves pinnately compound or decompound, very large; plants with aromatic or strong odor when crushed. 162.
161. Plants glabrous. **Ranunculus sceleratus.**
161. Plants hairy. **Ranunculus acris.**
162. Leaves simply pinnate or nearly so, the segments ovate or oval; stem strongly grooved and ribbed. **Pastinaca sativa.**
162. Leaves pinnately or ternately decompound, or if simply pinnate then the leaflets not ovate and the stem not strongly grooved. 163.
163. Stem leaves pinnate, the leaflets linear or lanceolate, the basal ones usually pectinately dissected. **Sium cicutaefolium.**
163. Stem leaves pinnately or ternately decompound. 164.

164. Plant tomentose-pubescent, coarse, tall; leaves ternately divided with broad segments; petiole hollow. **Heracleum lanatum.**
164. Plants glabrous. 165.
165. Leaves pinnately dissected; stems spotted. **Conium maculatum.**
165. Leaflets broad, not dissected. 166.
166. Stem purple; lower leaves often 2 ft. wide. **Angelica atropurpurea.**
166. Stem marked with purple lines; leaves usually less than 1 ft. long. **Cicuta maculata.**
167. Leaves densely white-tomentose beneath. 168.
167. Leaves glabrous or pubescent, not white-tomentose. 169.
168. Stem winged by the decurrent leaf-blades. **Centaurea solstitialis.**
168. Stem not winged. **Artemisia vulgaris.**
169. Leaves finely, 1-3 times, pinnately divided, or one or more times pinnatifid into linear lobes. 170.
169. Leaves not prominently pinnately dissected, but the divisions or lobes rather broad. 178.
170. Plant glabrous or very nearly so. 171.
170. Plant pubescent, strigose, or hispid. 174.
171. Plant strongly fetid or very sweet-scented. 172.
171. Plant neither fetid nor sweet-scented. 173.
172. Plant very fetid, 1-2 ft. high. **Anthemis cotula.**
172. Plant very sweet-scented, 2-5 ft. high. **Artemisia annua.**
173. Leaf-divisions of the finely dissected leaves linear and entire, other leaves oblong or broader; plant with cress taste. **Norta altissima.**
173. Leaf-divisions serrate; plant not with cress taste. **Artemisia biennis.**
174. Plant bristly-hispid, lower leaves finely 2-3 pinnate, the petiole base dilated and partly sheathing. **Daucus carota.**
174. Plant not bristly-hispid and petiole base not dilated and sheathing. 175.
175. Stem leaves petioled, the petiole sometimes wing-margined. 176.
175. Stem leaves sessile. 177.
176. Annual; leaves thin, usually 2-3 times pinnatifid, pubescent or hirsute. **Ambrosia elatior.**
176. Perennial; leaves thick, usually 1-2 times pinnatifid, strigose or hispid. **Ambrosia psilostachya.**
177. Perennial; stem erect. **Achillea millefolium.**
177. Annual or biennial; branches decumbent or ascending. **Anthemis arvensis.**

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178. Leaves palmately lobed, those on the stem sessile, the basal ones ovate or cordate and merely crenate. **Ranunculus abortivus.**
178. Leaves pinnately lobed. 179.
179. Leaves angle-lobed, broad and coarse, glabrous. 180.
179. Leaves not as above. 182.
180. Stem prominently angled; leaves not distinctly inequilateral at the base. 181.
180. Stem not angled; leaves, or some of them, inequilateral at the base, acute or short-acuminate at the apex; plant with rank odor. **Datura stramonium.**
181. Leaves narrow at the base, acuminate but blunt-pointed; corolla blue. **Physalodes physalodes.**
181. Leaves mostly truncate or cordate at the base, acuminate at the apex, mostly with a slender point; corolla none. **Chenopodium hybridum.**
182. Plants glandular-pubescent and strong-scented. **Chenopodium botrys.**
182. Plants not glandular-pubescent. 183.
183. Stems distinctly striate and succulent; plants tall; leaves thin, ovate-lanceolate, the upper sessile, the lower petioled. **Erechtites hieracifolia.**
183. Stems not striate and succulent though they may be angled. 184.
184. Perennial, glabrous or nearly so; stem leaves linear-spatulate, pinnately incised or toothed; basal leaves with long, slender petioles. **Chrysanthemum leucanthemum.**
184. Annual or biennial, or, if perennial, the leaves distinctly pinnately lobed with a large, terminal lobe. 185.
185. Plant sparsely hairy; leaves pinnatifid with lanceolate segments, the uppermost clasping, not with a cress taste; stem angled. **Phacelia purshii.**
185. Plant glabrous or pubescent, with a mustard or cress taste. 186.
186. Plant pale and somewhat glaucous, glabrous or nearly so; beak of pod ¼-⅓ the length of the body. **Brassica juncea.**

186. Plant darker green, not glaucous. 187.
187. Stem leaves lanceolate or oblong-linear, usually dentate; basal leaves obovate or spatulate with a large, terminal lobe and numerous, small, lateral ones. **Lepidium virginicum.**
187. Stem leaves broader. 188.
188. Stem angled, glabrous. 189.
188. Stem not angled. 190.
189. Leaf segments 1-4 pairs. **Barbarea barbarea.**
189. Leaf segments 4-8 pairs. **Barbarea verna.**
190. Stem usually glabrous; base of petiole often dilated; plants of wet places. **Radicula palustris.**
190. Stem usually hispid or pubescent. 191.
191. Leaves irregularly dentate or lobed; usually hispid with scattered, stiff hairs. **Sinapis arvensis.**
191. Leaves lyrate-pinnatifid, finely dentate; pubescent. **Brassica nigra.**

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192. Plants densely woolly or tomentose; in some species only white-tomentose on the leaves beneath, but then the leaves very large. 193.
192. Plants not woolly nor tomentose but glabrous or with ordinary hairs. 197.
193. Leaves strongly decurrent on the stout stem, densely long-woolly, the hairs long and branched. **Verbascum thapsus.**
193. Leaves not decurrent. 194.
194. Coarse biennials with very large, petioled leaves. 195.
194. Small or slender annuals or perennials with small leaves. 196.
195. Petioles solid, deeply furrowed; inner bracts equalling or exceeding the flowers. **Arctium lappa.**
195. Petioles hollow, not deeply grooved; inner bracts not exceeding the flowers. **Arctium minus.**
196. Low, stoloniferous, rosette perennials with obovate or broadly oval leaves. **Antennaria plantaginifolia.**
196. Erect, slender annuals with linear-lanceolate leaves. **Centaurea cyanus.**
197. Leaves all entire or nearly so. 198.
197. Leaves all, or at least the lower, serrate, dentate, repand-dentate, or repand-lobed. 215.
198. Pubescence stellate; scapose with tufted, obovate, basal leaves. **Draba caroliniana.**
198. Pubescence, if present, not stellate. 199.
199. Pith diaphragmed, with lenticular cavities; leaves oblong-lanceolate, petioled, glabrous; tall plants with unpleasant odor. **Phytolacca americana.**
199. Pith and plant not as above. 200.
200. Fleshy plants with thick, glabrous, succulent, ovate, obovate, or linear leaves. 201.
200. Plants not succulent, or, if somewhat so, the leaves different. 202.
201. Leaves obovate, entire; stems more or less prostrate; annual. **Portulaca oleracea.**
201. Leaves ovate, dentate; erect perennials. **Sedum triphyllum.**
201. Leaves linear, not petioled; erect annual forming a tumbleweed. **Salsola pestifer.**
202. Leaves with 3-5 distinct ribs, at least at the lower end. 203.
202. Leaves pinnately veined or with only the midrib showing. 205.
203. Plant pale-green and slightly glaucous, glabrous or glandular-pubescent. **Linaria linaria.**
203. Plant dark-green, not glaucous, pubescent. 204.
204. Plant hispid-hirsute; basal leaves thick, oblong-lanceolate, usually entire or with shallow serrations; ray-flowers yellow. **Rudbeckia hirta.**
204. Plant appressed-pubescent; basal leaves usually spatulate, usually serrate; ray-flowers white. **Erigeron ramosus.**
205. Leaves linear or lanceolate, not petioled, sparingly pubescent or decidedly villous. **Aster ericoides.**
205. Leaves broader, or if narrow then either with petioles or decidedly bristly or hispid-pubescent. 206.
206. Stem leaves distinctly petioled, glabrate, or if pubescent not rough-hispid or stiff-bristly. 207.
206. Stem leaves sessile and prominently rough-hispid or hirsute. 211.
207. Stems prostrate, forming mats; leaves obovate or spatulate, narrowed into slender petioles. **Amaranthus blitoides.**

207. Stems erect, sometimes forming tumbleweeds. 208.
208. Plants roughish-puberulent. 209.
208. Plants glabrous or nearly so. 210.
209. Leaves dull green, roughish, and more or less pubescent; panicle thick and glomerate. **Amaranthus retroflexus.**
209. Leaves smoother and deeper green; inflorescence more slender-cylindric and flexuous. **Amaranthus hybridus.**
210. Stem whitish, usually diffusely branched; leaves small, spatulate-oblong, the midvein excurrent. **Amaranthus graecizans.**
210. Stem usually tall and erect, green or striped with red; leaves ovate-lanceolate, mostly long-acuminate but obtuse at the tip, and mucronate or cuspidate. **Acnida tamariscina.**
211. Plants with long, bristly hairs, some coarse, some finer; biennial with oblong to linear-lanceolate leaves; flowers bright blue to purple. **Echium vulgare.**
211. Plants appressed-pubescent or merely hirsute, not with long, bristly hairs. 212.
212. Lower leaves oblong or oblong-lanceolate, slender-petioled, often obtuse; flowers reddish-purple. **Cynoglossum officinale.**
212. Lower leaves not slender-petioled or if slender-petioled the leaves ovate or nearly orbicular and cordate. 213.
213. Lower leaves ovate or nearly orbicular, cordate; corolla nearly white. **Lappula virginiana.**
213. Lower leaves spatulate, linear, or linear-lanceolate. 214.
214. Leaves pale green; flowers blue. **Lappula lappula.**
214. Leaves bright green; flowers white. **Lithospermum arvense.**
215. Stem distinctly fine-striate; usually glabrous, succulent, erect, tall annual with thin, ovate-lanceolate, sharply dentate or incised leaves. **Erechtites hieracifolia.**
215. Stem round or angled, not striate, or if striate the plant not as above. 216.
216. Leaves of the stem petioled. 217.
216. Leaves, at least all the upper, sessile; sometimes with winged petioles. 229.
217. Leaves white-mealy or white-scurfy on the lower surface or on both surfaces. 218.
217. Leaves not white-mealy. 220.
218. Leaves mostly hastate, the basal lobes divergent, acute or acuminate. **Atriplex hastata.**
218. Leaves not hastate. 219.
219. Stem tall and erect; sepals strongly keeled in fruit. **Chenopodium album.**
219. Stem decumbent; sepals not keeled. **Chenopodium glaucum.**
220. Plants glandular-aromatic; leaves lanceolate. **Chenopodium ambrosioides.**
220. Plants not glandular-aromatic. 221.
221. Leaves glabrous or nearly so, or sometimes slightly scurfy. 222.
221. Leaves hirsute, scabrous or rough. 225.
222. Stem prominently angled; leaves narrowed at the base, acuminate but blunt-pointed; corolla blue. **Physalodes physalodes.**
222. Stem prominently angled; leaves mostly truncate or cordate at the base, acuminate at the apex, mostly with a slender point; corolla none. **Chenopodium hybridum.**
222. Stem not prominently angled or, if prominently angled, the leaves not as above. 223.
223. Leaves pinnately veined, more or less inequilateral at the base. 224.
223. Leaves palmately veined or with 2-4 prominent side ribs from near the base, sometimes somewhat scurfy, acute or short-acuminate, at least the lower sinuate-dentate; flowers and fruit not enclosed in 2 bracts. **Chenopodium murale.**
223. Leaves with 2 prominent side ribs from near the base, sometimes somewhat scurfy, typically more or less sagittate, acute or short-acuminate, the upper often oblong-lanceolate to lanceolate and nearly entire; flowers and fruit enclosed in 2 prominent bracts. **Atriplex hastata.**
224. Leaves 3-8 in. long, with strong odor. **Datura stramonium.**
224. Leaves 1-3 in. long, not with disagreeable odor. **Solanum nigrum.**
225. Leaves oblanceolate, the blades narrowed into margined petioles. **Leptilon canadense.**
225. Leaves broadly ovate to oblong or oval. 226.
226. Leaves broadly ovate, obtuse or acute. 227.
226. Leaves ovate, ovate-oblong, or broadly oval, acute or acuminate. 228.
227. Beaks of the bur incurved; the bur or its prickles more or less hispid. **Xanthium pennsylvanicum.**
227. Beaks of the bur nearly straight; the bur and its prickles glabrous or nearly so. **Xanthium americanum.**
228. Leaves broad, ovate, acute or acuminate; annuals with tall, thick stems. **Helianthus annuus.**

228. Leaves ovate-oblong, acuminate; perennials by thickened, fleshy rhizomes bearing tubers. **Helianthus tuberosus.**

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229. Leaves pinnately veined; not subulate, nor linear, nor linear-lanceolate. 230.
229. Leaves mostly triple-nerved or with 2 or more prominent side ribs coming from near the base of the blade; blades sometimes subulate, linear, or linear-lanceolate. 235.
230. Hairs 2-branched. **Cheirinia repanda.**
230. Hairs, if present, not 2-branched. 231.
231. Plant usually glabrous; heads with yellow disk-flowers and prominent, white rays; leaves incised-dentate. **Chrysanthemum leucanthemum.**
231. Plant more or less pubescent, at least above or on the leaves beneath. 232.
232. Leaves finely serrate, lanceolate, tapering at the base. **Vernonia altissima.**
232. Leaves dentate or repand-denticulate, truncate or somewhat narrowed at the base or with winged petioles. 233.
233. Leaves lanceolate to ovate-lanceolate, repand-denticulate, usually short hirsute-pubescent. **Oenothera biennis.**
233. Leaves oblong, ovate-lanceolate, or ovate-spatulate, dentate, laciniate or nearly entire. 234.
234. Leaves dentate or more or less laciniate, more or less glandular-pubescent. **Verbascum blattaria.**
234. Leaves coarsely dentate, ovate-spatulate, prominently long-hairy, not glandular. **Erigeron annuus.**
234. Leaves dentate or nearly entire, linear-lanceolate or oblong-lanceolate, appressed-pubescent or nearly glabrous, not glandular. **Erigeron ramosus.**
235. Stem leaves subulate or linear. **Aster ericoides.**
235. Stem leaves wider. 236.
236. Stem leaves ovate-oblong to oblong-lanceolate, thick; stem and leaves rough or hispid. 237.
236. Stem leaves mostly linear or oblong-lanceolate, thin. 238.
237. Leaves sparingly serrate with low teeth or entire, acute or acutish; biennial or sometimes annual. **Rudbeckia hirta.**
237. Leaves prominently serrate, long-acute or acuminate at the apex; perennial by slender rhizomes. **Helianthus doronicoides.**
238. Perennial; stem leaves acuminate; flower-heads yellow; growing tip, nodding. **Solidago canadensis.**
238. Annual or biennial; leaves not acuminate; flowers not yellow. 239.
239. Stem leaves more or less spatulate, long-pubescent or ciliolate especially toward the base, covering the stem and more or less crowded. **Leptilon canadense.**
239. Stem leaves oblong-lanceolate, linear-lanceolate, or ovate-oblong, not conspicuously covering the stem. 240.
240. Plant sparingly pubescent with spreading hairs; leaves usually coarsely dentate. **Erigeron annuus.**
240. Plant more or less appressed-pubescent; stem leaves nearly all entire or nearly so. **Erigeron ramosus.**

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Rosettes of scapose plants and typical annual and biennial rosettes of leafy-stemmed plants

241. Sap milky. 242.
241. Sap not milky. 249.
242. Leaves spinulose-dentate on the margins, in one species sparingly so; leaves pale or gray-green, sometimes with the midrib prickly-hispid beneath. 243.
242. Leaves not spinulose-dentate, if with slender teeth then these soft and the petiole and rachis usually hollow. 247.
243. Midrib of leaf prickly-hispid beneath; leaves lobed or merely dentate. **Lactuca virosa.**
243. Midrib not prickly-hispid. 244.
244. Midrib pubescent beneath; leaves sparsely spinulose-dentate except the points of the rather broad, distant lobes. **Lactuca canadensis.**
244. Midrib glabrous or if not then the margin of the leaf abundantly spinulose-dentate. 245.

245. Leaves divided, with very distant, narrow lobes and a rather narrowly margined midrib; glabrous. **Lactuca saligna.**
245. Leaves with broader, not distant lobes and broadly or narrowly margined midrib; glabrous or slightly pubescent. 246.
246. Perennial with creeping rhizomes; midrib broadly margined and lobes rather distant; rigidly spinulose-dentate. **Sonchus arvensis.**
246. Annual; midrib and petiole nárrowly margined, usually with prominent lobes and rather softly spiny-toothed. **Sonchus oleraceus.**
246. Annual; leaves spatulate or spatulate-ovate, inclined to be only slightly or not at all lobed, if lobed the midrib and petiole broadly margined, prominently and rigidly spiny-toothed. **Sonchus asper.**
247. Petiole and leaf rachis usually hollow; leaves with long, scattered hairs, usually pinnatifid and sinuate-dentate with long, soft points, rarely nearly uncut. **Leontodon taraxacum.**
247. Petiole and leaf rachis not hollow; leaves glabrous or rather short-pubescent, the teeth not with long, soft points. 248.
248. Leaves pubescent, spatulate or oblong-lanceolate, usually not over 5 in. long. **Cichorium intybus.**
248. Leaves glabrous, narrowly oblong to linear-lanceolate, up to 8 in. long. **Apargia autumnale.**

— *249* —

249. Plants prickly. 250.
249. Plants not prickly. 254.
250. Leaves glabrous or nearly so, except for the prickles; sometimes woolly below, then perennial by rhizomes. 251.
250. Leaves densely white-tomentose on both sides or below; biennials. 252.
251. Biennial; leaves crenate with prickles on the midrib beneath. **Dipsacus sylvestris.**
251. Perennial by horizontal roots; leaves deeply pinnatifid into very prickly lobes. **Cirsium arvense.**
252. Leaves white-tomentose all over, oblong and dentate, very spiny. **Onopordon acanthium.**
252. Leaves glabrous or hispid above. 253.
253. Leaf lobes triangular-lanceolate, tipped with stout spines; leaves hispid above, the blade along the midrib broad. **Cirsium lanceolatum.**
253. Leaf lobes lanceolate or oblong, usually tipped with a slender spine; leaves glabrous above, the blade along the midrib narrow because of the deep-cut lobes. **Cirsium muticum.**
254. Leaves densely long-woolly on both sides or white-tomentose, sometimes only on the lower side and petioles. 255.
254. Leaves neither densely long-woolly nor white-tomentose but pubescent, tomentose-pubescent, or glabrous. 259.
255. Leaves densely woolly on both sides with long, branched hairs. **Verbascum thapsus.**
255. Leaves tomentose, long-petioled and large, or short-petioled and small. 256.
256. Plants stoloniferous, with spatulate or obovate, 3-5-ribbed, floccose-woolly leaves. **Antennaria plantaginifolia.**
256. Plants not stoloniferous; leaves large, long-petioled. 257.
257. Leaves ternately divided, the segments broadly ovate, sharply serrate, and long-acute. **Heracleum lanatum.**
257. Leaves slightly or not at all lobed, repand-dentate. 258.
258. Petioles hollow, not deeply furrowed. **Arctium minus.**
258. Petioles solid, deeply furrowed. **Arctium lappa.**

— *259* —

259. Pubescence of stellate or forked hairs; rosettes small, the leaves spatulate or obovate and nearly entire. 260.
259. Pubescence when present of simple hairs, or if of forked hairs then the rosettes not as above. 261.
260. Leaves oblong or spatulate-oblong; petals deeply 2-cleft. **Draba verna.**
260. Leaves obovate; petals entire. **Draba caroliniana.**
261. Leaves entire or nearly so, sometimes prominently parallel-ribbed or 3-5-nerved, and then sometimes toothed. 262.

261. Leaves variously toothed, crisped, undulate, lobed, hastate, or compound, never prominently parallel-ribbed. 269.
262. Leaves broad and prominently longitudinally ribbed, glabrous or only short- and soft-pubescent. 263.
262. Leaves narrow, lanceolate or linear, or if broad then rough-pubescent and not with numerous, parallel ribs. 264.
263. Leaves yellow-green. **Plantago rugelii.**
263. Leaves pale gray-green. **Plantago major.**
264. Leaves prominently longitudinally ribbed, soft-pubescent or villous-pubescent. 265.
264. Leaves pinnately veined or 3-5-nerved but not longitudinally ribbed; hispid or rough-pubescent, or with soft, short hairs. 266.
265. Leaves narrowly oblong-lanceolate. **Plantago lanceolata.**
265. Leaves linear. **Plantago aristata.**
266. Leaves linear to spatulate, obtuse, hispid or somewhat appressed-pubescent; annual. **Lappula lappula.**
266. Leaves linear to linear-lanceolate, acute, stiff-bristly with long hairs; biennial. **Echium vulgare.**
266. Leaves oblong, oblong-lanceolate, or ovate-spatulate. 267.
267. Base of leaf cordate. **Lappula virginiana.**
267. Base of leaf narrowed into the petiole. 268.
268. Leaf with soft, short hairs. **Cynoglossum officinale.**
268. Leaf thick, rough bristly-hairy. **Rudbeckia hirta.**
268. Leaf thin, sparingly pubescent or nearly glabrous. **Erigeron ramosus.**
269. Leaves palmately compound with 3-5 leaflets and with stipules. 270.
269. Leaves not with 3-5 palmate leaflets though they may be 3-5-lobed or divided. 271.
270. Leaves with 3 leaflets. **Potentilla monspeliensis.**
270. Leaves usually with 5 leaflets. **Potentilla canadensis.**
271. Leaves hastate, the upper part entire; with membranous stipules or ocreae; glabrous perennial. **Rumex acetosella.**
271. Leaves not hastate. 272.
272. Leaves palmately veined or with two or more prominent side ribs from the base of the blade, crenate or palmately lobed or dissected. 273.
272. Leaves pinnatifid, pinnately dissected, or compound, or, if entire, toothed, or lobed, then not palmately veined. 276.
273. Leaves ovate or reniform, crenate. **Ranunculus abortivus.**
273. Leaves lobed or cleft. 274.
274. Leaves with stipules, the blades deeply cleft into 5-9 oblong, obovate or cuneate, toothed or lobed segments. **Geranium carolinianum.**
274. Leaves without stipules but the petiole with expanded base. 275.
275. Plant glabrous. **Ranunculus sceleratus.**
275. Plant more or less pubescent. **Ranunculus acris.**

— *276* —

276. Leaf blade dissected into many, narrow, compound divisions, bristly-hispid or tomentose-pubescent. 277.
276. Leaf blade not finely dissected. 278.
277. Leaves bristly-hispid; leaf segments lanceolate, dentate or lobed. **Daucus carota.**
277. Leaves tomentose-pubescent; leaf segments finely dissected. **Achillea millefolium.**
278. Leaves compound, very large, 1-2 ft. long, glabrous or pubescent. 279.
278. Leaves simple, or, if apparently compound, much smaller. 280.
279. Leaves pinnate. **Pastinaca sativa.**
279. Leaves biternate and the divisions pinnate; petiole hollow. **Angelica atropurpurea.**
279. Leaves ternately divided, the segments broadly ovate, sharply serrate, tomentose-pubescent below; petiole hollow. **Heracleum lanatum.**
280. Leaves with very large, membranous, sheathing stipules; leaves large, entire or nearly so, oblong or lanceolate-oblong. 281.
280. Leaves without stipules. 282.
281. Leaves much crisped; broadly linear-lanceolate, not at all or only slightly cordate at the base, acute at the apex. **Rumex crispus.**
281. Leaves only slightly crisped, oblong, prominently cordate at the base, obtuse or rounded at the apex. **Rumex obtusifolius.**
282. Plant with forked or stellate hairs; annuals or biennials. 283.

282. Plant glabrous, or if pubescent the hairs not forked though they may sometimes be in pairs. 284.
283. Basal leaves usually more or less lobed or pinnatifid, rarely entire. **Bursa bursa-pastoris.**
283. Basal leaves coarsely toothed or repand-denticulate. **Cheirinia repanda.**
284. Leaves dentate, repand-denticulate, or entire. 285.
284. Leaves lobed or pinnatifid, sometimes with small lobes only at the base. 291.
285. Leaves glabrous, short-petioled; annual. **Thlaspi arvense.**
285. Leaves glabrous, long-petioled; perennial. **Chrysanthemum leucanthemum.**
285. Leaves pubescent. 286.
286. Leaves granular-viscid on the under side; hairs often in pairs. **Lepidium campestre.**
286. Leaves not granular-viscid; not with some hairs in pairs. 287.
287. Leaves repand-denticulate, slender-petioled, hirsute-pubescent. **Oenothera biennis.**
287. Leaves serrate-dentate, serrate, or crenate. 288.
288. Leaves hispid-pubescent, the petiole long-ciliate; annual. **Leptilon canadense.**
288. Leaves soft-pubescent, appressed-pubescent, or sparingly-pubescent; petioles not long-ciliate, though they may have ordinary marginal hairs. 289.
289. Perennial by stolons and offsets; soft-pubescent; leaves spatulate or obovate, obtuse, dentate. **Erigeron philadelphicus.**
289. Annual; pubescent or appressed-pubescent. 290.
290. Leaves ovate or ovate-lanceolate, usually coarsely dentate; pubescence spreading. **Erigeron annuus.**
290. Leaves spatulate or oblong, usually serrate; pubescence more appressed. **Erigeron ramosus.**

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291. Leaves granular-viscid on the under side, often with paired hairs. **Lepidium campestre.**
291. Leaves not granular-viscid, not with paired hairs. 292.
292. Leaves obovate or spatulate in outline, usually with a large, long, dentate, terminal lobe and numerous, small, lateral ones; glabrous or slightly pubescent. **Lepidium virginicum.**
292. Leaves not as above. 293.
293. Leaves sessile or with a short petiole, glabrous or sparingly glandular-pubescent. **Verbascum blattaria.**
293. Leaves with prominent petioles which may be winged. 294.
294. Plant with a tansy-like odor when crushed; leaves narrowed into long, slender petioles. **Chrysanthemum leucanthemum.**
294. Plant without a taste or odor, or with a mustard-like or cress-like taste and odor. 295.
295. Terminal lobe of leaf very much larger than the 1-4 pairs of lateral ones, oval or obovate, more or less cordate; glabrous. **Barbarea barbarea.**
295. Leaves not as above. 296.
296. Plants pubescent with rather long, scattered, stiff hairs. **Erysimum officinale.**
296. Plants glabrous or very slightly pubescent. 297.
297. Leaves with rather long, slender, lateral lobes, becoming linear on the stem. **Norta altissima.**
297. Leaf blades rather broad, usually ovate. 298.
298. Lobes usually distinctly toothed. **Radicula palustris.**
298. Lobes repand-toothed or entire. **Barbarea verna.**

DESCRIPTIVE ILLUSTRATED LIST OF OHIO WEEDS

*The more troublesome weeds are marked with this symbol.
**The important poisonous plants are marked with this symbol.

Class, MONOCOTYLAE. Monocotyls

CYPERACEAE. SEDGE FAMILY

1. ***Cyperus esculentus** L. Nut-grass (Cyperus). Chufa.— Solid, 3-angled, yellowish-green, stout, erect, simple stems; long, narrow, light green leaves arranged in 3 spirals near the base; and numerous, slender, oblong, flattened spikelets, borne on 4-10 unequal, often-branched rays of the terminal inflorescence that is both subtended and exceeded by 3-6 leaf-like bracts. Each spikelet is composed of a narrowly-winged axis bearing many, 2-ranked flowers, each enclosed by an ovate-oblong, straw-colored glume. The small, blunt, 3-angled, obovoid fruit is yellowish-brown in color.

Native perennial, propagated by seeds and by short, scaly, underground stems bearing small, fleshy tubers that send up new stems at close intervals. Flowering period: midsummer and fall.—Abundant only in wet soil of undrained fields and along streams or ditches, often persisting after the land is drained; most abundant in the western half of Ohio.

Control.—Good drainage is essential, followed by hoeing or clean cultivation throughout several seasons to prevent seed production and gradually to starve out the underground stems and tubers. Fallowing during the late summer or fall is also a valuable method in case the infestation is so heavy that crops cannot be profitably grown.

GRAMINACEAE. GRASS FAMILY

2. ***Bromus hordeaceus** L. Soft Chess. Soft Brome.— Erect, often slender, simple stems, generally hairy below the panicle; hairy sheaths, shorter than the internodes; flat, hairy blades; and short-stalked, several-flowered spikelets in an erect, rather compact, terminal panicle. The lower empty glume is 3-nerved, the upper one is 5-9-nerved; the hairy lemma is 2-toothed at the apex and often bears a short, straight awn from between the teeth.

Introduced annual or winter annual; propagated by seeds. Flowering period: throughout the summer.—In fields and waste places; not so abundant as common chess but equally troublesome when introduced.

Control.—Same methods as for common chess.

3. ***Bromus secalinus** L. Common Chess. Chess. Cheat.— Smooth, erect, simple stems; smooth or lightly hairy, strongly nerved sheaths; flat blades, slightly hairy above but smooth beneath; and long-stalked, 5-15-flowered spikelets in an open, usually drooping panicle. The lower empty glume is 3-nerved, the upper one is 5-9-nerved; the smooth or minutely roughened lemma has inrolled margins, 2 blunt teeth at the apex, and usually a very short, straight, rather weak awn from between the teeth.

Annual or winter annual naturalized from Europe; propagated by seeds. Flowering period: throughout the summer.—Common in fields and waste places; often a troublesome weed in winter grains; general and abundant in Ohio.

Control.—Prevent seed production; hand-pulling or close cutting is satisfactory for scattered plants or small patches in grainfields. Plants with partly ripe seeds should be collected and burned. Grainfields in which common chess has been allowed to seed abundantly should be put under a rotation that includes a cultivated crop, as well as a heavy stand of legumes or grasses mowed early to prevent seeding of the chess plants. Winter grains should be avoided until this grass has been brought under control. Mowing of waste ground is necessary. The use of clean seed grain is essential to prevent reinfestation.

The following treatment is sometimes necessary on land badly fouled with common chess: Shallow plowing after harvest of the winter grain crop, followed by harrowing to induce germination; rolling is advisable during a dry season. The seedlings may be destroyed with a spring-tooth or disk harrow. Repeat surface cultivation several times until late fall. Plow deeper to bring up a fresh supply of seeds. The field should be harrowed early the next spring to kill the winter crop of seedlings. Plant to a cultivated crop or to a spring grain, such as oats or barley in which alfalfa or clover is seeded.

Notes.—Wheat does not degenerate into chess; both come true from their own seed. Seeds of chess retain their vitality several years when buried in the soil and thus may appear

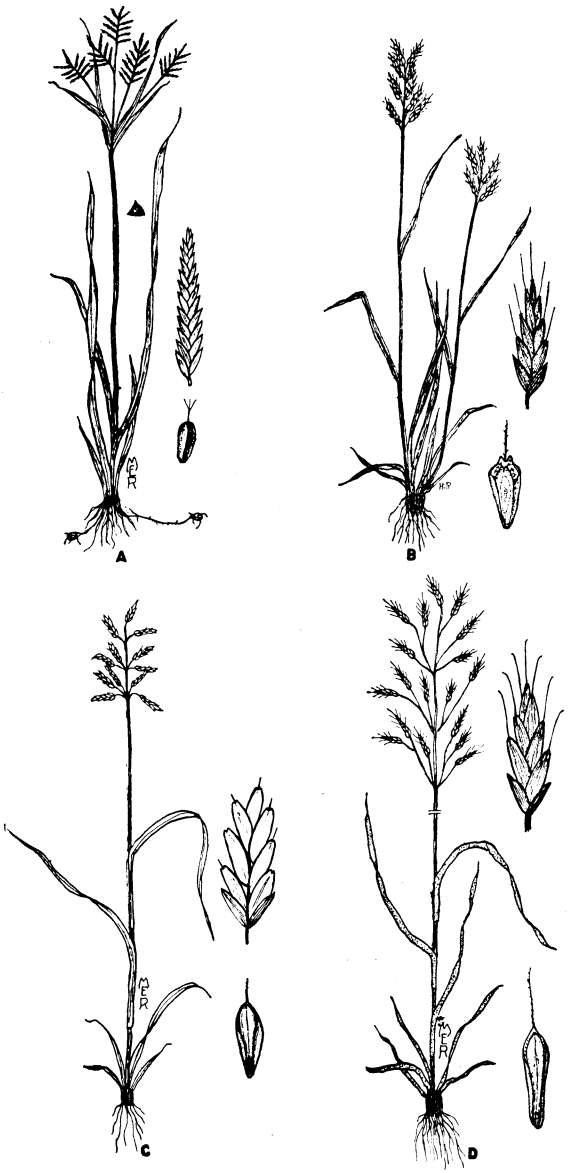

Fig. 1

a. **Cyperus esculentus** (Nut-grass)
b. **Bromus hordeaceus** (Soft Chess)
c. **Bromus secalinus** (Common Chess)
d. **Bromus racemosus** (Upright Chess)

in a grain field where clean seed was sown. The hardier chess plants are often abundant in patches where the wheat was winter-killed. These facts help to explain the erroneous belief in this old superstition. Flour made from wheat containing chess has a dark color and disagreeable flavor.

4. ***Bromus racemosus** L. Upright Chess.— Erect, simple stems, lightly hairy below the panicle; softly hairy sheaths; hairy blades; and stalked, broadly lance-shaped, 5-11-flowered spikelets in a panicle with erect or ascending branches. The lower empty glume is 3-nerved, the upper one is 5-9-nerved; the smooth or slightly roughened lemma is not inrolled at the margins but has a straight, medium-length awn from between the teeth at the apex.

Annual naturalized from Europe; propagated by seeds. Flowering period: throughout the summer.—In fields and waste places; general and abundant in Ohio.

Control.—Same methods as for common chess.

5. ***Bromus tectorum** L. Downy Brome-grass. Slender Chess.— Smooth, slender, erect, simple stems; softly hairy sheaths, generally longer than the internodes; flat, softly hairy blades; and numerous, small, stalked, 5-8-flowered spikelets on very slender, recurved stalks, forming an open, drooping, 1-sided panicle. The lower empty glume is 1-nerved, the longer upper one is 3-nerved, both pointed and usually roughened; the 7-nerved lemma has inrolled margins, toothed apex, and a straight awn that is longer than the body of the lemma.

Annual or winter annual introduced from Europe; propagated by seeds. Flowering period: late spring and summer.—In fields, waste places, and along roadsides; general and abundant in Ohio.

Control.—Same methods as for common chess, but the plants must be destroyed earlier in the season to prevent seed production.

6. **Eragrostis major** Host. (*Eragrostis megastachya* (Koeler) Link.) Strong-scented Love-grass. Stinking-grass.— Smooth, generally much-branched stems, erect or often decumbent toward the base; smooth sheaths with a ring of short hairs at the junction with the flat blades, which are rough above but smooth beneath; and small, very flat, grayish-green, short-stalked, 5-35-flowered spikelets in a dense terminal panicle with spreading or ascending branches. The unequal, ridged empty glumes are pointed at the apex; the thin, blunt, roughened lemma has prominent lateral nerves. The small reddish grains scatter readily when ripe. This grass has a marked odor.

Annual naturalized from Europe; propagated by seeds. Flowering period: midsummer to early fall.—A common weed in cultivated fields, yards, waste places, as well as sometimes in lawns and gardens; general distribution in Ohio.

Control.—Prevent seed production by hoeing, hand-pulling, or clean, thorough, late-continued cultivation.

7. **Danthonia spicata** (L.) Beauv. Common Wild-oat-grass. Poverty-grass.— Smooth, wiry, erect, simple stems; generally smooth sheaths; rough, narrow, rolled leaves, the lower ones mostly in a tuft at the base; the few upper leaves short and erect; and 5-8-flowered spikelets on short, erect stalks, forming a small, rather contracted, terminal panicle with erect or ascending branches. The ridged, pointed empty glumes are usually longer than the uppermost flower; the broadly oblong, sparsely appressed-hairy lemma has 2 triangular teeth at the apex and a flat, bent, twisted awn longer than the body of the lemma. The small, hard grain is free from the flowering glumes.

Native perennial, propagated by seeds. Flowering period: throughout the summer.—This weed is especially abundant in run-down, poorly seeded grasslands; it flourishes in dry, rocky, unfertile soils; general distribution in Ohio.

Control.—This grass is crowded out when the fertility, mechanical condition, and water-holding capacity of the soil have been improved sufficiently to support a good growth of crop plants. Fertilization, cultivation, rotation with clover, and reseeding with valuable grasses will bring this weed under control.

8. **Avena fatua** L. Wild Oats.— Smooth, erect, simple stems, usually growing in tufts; smooth or sparingly rough-hairy sheaths, often over-lapping below; long, smooth blades; and large, pendulous, 2-4-flowered spikelets in an ample, open panicle. The empty glumes are smooth, membranous, many-nerved, as long as or longer than the spikelets exclusive of the awn; the lemma is hardened at the base, covered with long, brownish, bristly hairs and bears a long, stiff, twisted, dorsal awn. The oblong, deeply furrowed grain is enclosed in the flowering glumes.

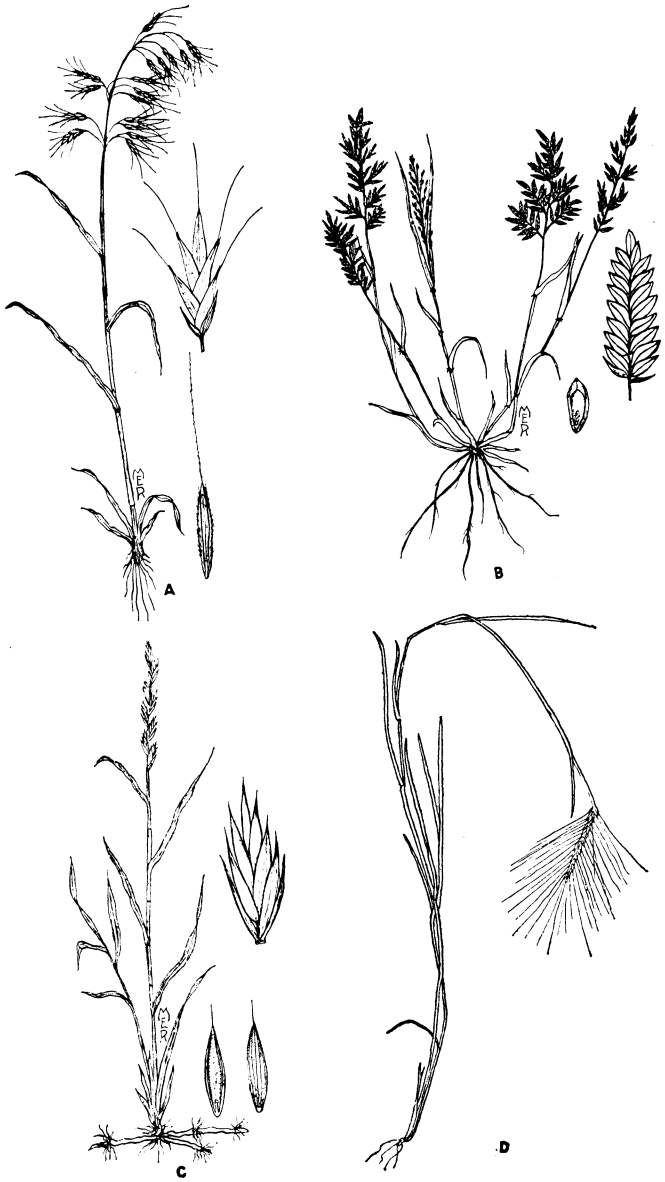

Fig. 2

a. **Bromus tectorum** (Downy Brome-grass)
b. **Eragrostis major** (Strong-scented Love-grass)
c. **Agropyron repens** (Couch-grass)
d. **Hordeum jubatum** (Squirrel-tail Barley)

After Selby.

Annual introduced from Europe; propagated by seeds. Flowering period: summer.—In fields and waste places but most troublesome in grain crops, especially oats. This weedy grass is not common in Ohio but is apt to be introduced in oats, forage, and other crop seeds from the western states.

Control.—Hand-pulling and burning before the seeds ripen are satisfactory for scattered plants in grainfields and waste places. Surface cultivation after harvest will induce the germination of seeds in grainfields that have been fouled by seeds scattered before or during harvest. A rotation that includes a clean cultivated crop followed by clover, alfalfa, or grasses for hay or pasture should be followed. Avoid oats in the rotation until the weed has been destroyed.

Notes.—Wild oats is objectionable for the following reasons: The seeds ripen unevenly, some of them before the grain crop; buried seeds remain viable several years and will grow through a deeper layer of soil than the cultivated grains; the stiff twisted awns are injurious to the mouths and digestive tracts of animals. The alternate twisting and untwisting of the awn in dry and wet weather serves to attach the seeds firmly to sacks or the wool of sheep and to bury them in the soil.

9. ***Agropyron repens** (L.) Beauv. Couch-grass. Quack-grass. Wheat-grass.— Simple aerial stems from creeping, matted, underground stems; smooth sheaths, shorter than the internodes; flat, narrow blades, rough above but smooth beneath; and 3-7-flowered spikelets in 2 opposite rows with the broad side of the spikelet turned toward the axis, forming a simple terminal spike. The empty glumes are rigid, several-nerved, pointed or awned; the 5-7-nerved lemma is rounded on the back and is either awn-pointed or has an awn usually not more than one-half as long as the body. The oblong grain usually remains attached to the palet.

Perennial introduced from Europe; propagated both by seeds and underground stems. Flowering period: summer.—In fields, gardens, along roadsides, and in waste ground; a persistent weed in cultivated land, found locally in most counties of Ohio.

Control.—Control is costly in time and money; for methods consult the section on methods of control and eradication for certain noxious perennial weeds.

Notes.—Couch-grass has value as a pasture or hay plant and is an excellent soil binder for embankments, but the objectionable features far overrule its good qualities. The mat-like habit of growth crowds out crop plants and interferes with their water supply. This plant is often infected with the poisonous ergot fungus.

10. **Hordeum jubatum** L. Squirrel-tail Barley. Squirreltail-grass.— Smooth, simple, tufted stems, erect or the lower joints decumbent; smooth, mostly loose sheaths; rough, flat, erect blades; and spikelets with very long awns, borne in groups of 3 on opposite sides of the jointed, flattened axis, forming a nodding, brush-like spike. Empty glumes equal, stiff, rough, pointed; the lemma of the fertile, sessile, central spikelet obscurely 5-nerved with a long, rough, slender awn; lemmas of the sterile, stalked, lateral spikelets smaller with shorter awns. Grain is usually adherent to the palet.

Biennial naturalized from the West; propagated by seeds. Flowering period: throughout the summer.—In fields, pastures, and meadows, as well as along roadsides and railways; it grows well in dry soils; common in the western and northwestern counties of Ohio.

Control.—Prevent seed production. Hand-pulling and burning before the seeds are formed is advisable for scattered plants or small patches; large patches may be burned over to destroy seeds on the ground, as well as the plants. Infested pastures, meadows, roadsides, and waste ground should be mowed before the first seeds are formed and frequently enough thereafter to prevent late seeding. Wild barley is rather easily destroyed by clean cultivation. A badly infested pasture or meadow should be planted to a cultivated crop.

Notes.—The seeds are easily disseminated by wind and water and are often carried in the coats of animals or in baled hay. Wild barley is also objectionable because it grows in compact clumps from fibrous, clustered roots that tend to crowd out other grasses. The long, barbed awns in pasture or hay are injurious to the mouth, nose, eyes, and alimentary tract of animals and often cause swelling and ulcers.

11. **Eleusine indica** (L.) Gaert. Yard-grass.— Smooth, tufted, flattened stems, erect or the lowest joints decumbent, generally branched at the base; loose, over-lapping, smooth or sparingly soft-hairy sheaths, often crowded at the base of the stem; rather thick, flat, pale green blades; and several-flowered, appressed, over-lapping, sessile spikelets in 2 rows on one side of the 2-10 finger-like spikes. The empty glumes are unequal, roughened on the keel, the first 1-nerved, the second 3-7-nerved; the lemma is 3-5-nerved. The black grain is loosely enclosed in the flowering glumes.

Annual naturalized from the warmer regions of the Old World; propagated by seeds. Flowering period: summer and early fall.—In yards, waste places, along walks, and roadsides; sometimes a troublesome weed in lawns, athletic fields, and golf courses; general distribution in Ohio.

Control.—Prevent seed production by hoeing, hand-pulling, or close cutting. The dense mat-like growth makes it difficult to cut. Large infested areas should be put under cultivation. Scattered plants in lawns may be destroyed by application of a few drops of carbolic or sulphuric acid to the crown.

12. **Panicum dichotomiflorum** Mx. Spreading Panic-grass.— Stout, flattened stems, at first erect and simple but later decumbent and branched at the upper nodes; smooth, loose, flattened sheaths; long, broad blades with rough margins as well as central nerve; and smooth, crowded, often purplish, unawned, lance-shaped, 2-flowered spikelets in a large, open, pyramidal panicle. Membranous empty glumes very unequal, the outer one about ¼ the length of the spikelet; the fertile flowering glumes hardened in fruit; the shining, ellipse-shaped, fertile lemma has thick inrolled margins. The grain is free but enclosed in the flowering glumes.

Native annual, propagated by seeds. Flowering period: summer and early fall.—In cultivated fields and moist fertile soils of waste places; general distribution in Ohio.

Control.—Prevent seed production by close cutting before bloom or by clean tillage of a cultivated crop; infested areas of waste ground should be mowed.

Notes.—It frequently makes a heavy growth after the crop is mature or has been harvested. Cattle and horses are fond of this grass when it is young but later it becomes dry and unpalatable.

13. ***Panicum capillare** L. Tumble Panic-grass. Old-witch-grass.— Stout, flattened, erect or ascending, simple or sparingly branched stems; bristly-hairy sheaths; rather broad, somewhat less bristly-hairy blades; and very small, distant, unawned, pointed, lance- or ellipse-shaped spikelets on the hair-like branches of the large panicle that is more or less included in the sheath until maturity, when it is open and frequently ½ the length of the plant. The outer empty glume is from ¼-½ as long as the spikelet.

Native annual, propagated by seeds. The panicles break off when mature, forming tumbleweeds that scatter the seeds widely and later collect in piles along fence rows. Flowering period: summer and early fall.—A bad weed in cultivated soil such as cornfields and gardens, as well as in waste places; it may appear in worn-out meadows and pastures; flourishes in dry soils; general and abundant in Ohio.

Control.—Prevent seed production by close cutting, hoeing, or hand-pulling before bloom, or by clean cultivation. The character of this plant as a tumbleweed makes the mowing of waste ground doubly important; burning is advisable if the seeds have ripened.

14. ***Syntherisma sanguinale** (L.) Dulac. (*Digitaria sanguinalis* (L.) Scop.) Large Crab-grass. Finger-grass.— Smooth, spreading, branched stems, usually decumbent at the base, frequently rooted at the lower nodes, often mat-forming; rough-hairy sheaths; flat long-pointed blades, usually rough-hairy at the base; and green or purplish, broadly lance-shaped, pointed spikelets on one side of the 3-12 long, slender spikes arranged in a loose whorl at the top of the stem. The spikelets are in pairs, one sessile but the other on a minute, 3-angled stalk. The outer empty glume is very small, but the 3-nerved inner one is from ⅓-½ as long as the spikelet; the parchment-like fertile lemma has colorless but not inrolled margins; the palet is similar in texture. The grain is free but enclosed in the flowering glumes.

Annual naturalized from Europe; propagated by seeds and by roots produced at the lower nodes. Buried seeds remain viable for several years. Flowering period: summer and early fall.—A very troublesome weed in lawns, gardens, and cultivated fields; also grows in meadows, thin pastures, waste ground, and along roadsides; general distribution in Ohio.

Control.—Prevent seed production by hoeing, hand-pulling, or clean cultivation of a tilled crop continued as late in the season as possible and supplemented by hand methods after tillage has been discontinued. When the size of the area permits, it is advisable to remove the plants after uprooting since stems in contact with the soil are apt to root at the nodes, especially during a wet season. Surface cultivation after the removal of the crop will prevent late plants from seeding. Infested roadsides and waste ground should be mowed, allowing the plants to grow tall but cutting before the seeds are ripe. Fertilization and reseeding are beneficial for thin, infested, permanent pastures. A vigorous growth of perennial grasses tends to prevent the germination and growth of such annuals.

Large crab-grass is often a most unsightly invader in lawns during the latter half of the season. Several seasons of persistent effort are necessary to bring this annual grass under control in a thin, neglected lawn. Digging is practicable only for scattered plants or small patches. Such bare areas should be replanted with clean seed. The effectiveness of mowing the wiry crab-grass stems is increased if they are first raised with a rake and then mowed in the opposite direction. The operation should be repeated at intervals of several days but in a direction opposite to the previous one. The clippings should be collected in a grass catcher and burned if ripe heads are present. Proper fertilization in the spring and at monthly intervals thereafter will promote good coverage by the turf grasses and thereby tend to crowd out the crab-grasses that spring up during late summer.[1] Badly infested lawns may require the establishment of a new turf.

15. **Syntherisma ischaemum** (Schreb.) Nash. Small Crab-grass. Smooth Finger-grass.—Smooth, spreading or decumbent, much-branched stems; smooth sheaths; smooth, narrow, pointed blades; and green or purplish, lance-shaped spikelets on one side of the 2-6 slender, terminal spikes. The spikelets are generally in pairs, one sessile but the other on a minute, round stalk. The outer empty glume is wanting or minute but the densely short-hairy inner one is nearly as long as the spikelet; the flowering glumes are similar to those of the preceding species but darker in color.

Annual introduced from Europe; propagated by seeds and by roots produced at the lower nodes. Flowering period: summer and early fall.—Same habitats as large crab-grass but neither as abundant nor as widely distributed.

Control.—Same methods as for large crab-grass.

16. ***Echinochloa crus-galli** (L.) Beauv. Common Barnyard-grass. Cockspur-grass.—Smooth, stout stems, often branched at the base; smooth, flattened sheaths; long, broad, smooth blades with a prominent midrib as well as roughened margins; and nearly sessile, ovate, green or purplish, 1-seeded spikelets crowded in 2-4 irregular rows on one side of the sessile, erect, or spreading branches of the ample panicle. The unequal, jointed empty glumes are bristly-hairy; the sterile lemma is more or less awned; the ovate, pointed, parchment-like, fertile lemma has inrolled margins. The ovoid grain is free but enclosed in the flowering glumes.

Annual naturalized from Europe; propagated by seeds. Flowering period: late summer and fall.—A common weed in cultivated fields especially on moist soils enriched with manure or fertilizer, lowland fields where the cultivated crop was harvested early, gardens, barnyards, along roadsides, and in waste places; general and abundant in Ohio.

Control.—Prevent seed production by frequent mowing or by clean cultivation of a hoed crop, continued as late in the season as possible.

Notes.—The rapid growth of late summer has forage value equal to that of the millets, and stock will eat it if it is cut previous to seeding.

17. **Chaetochloa verticillata** (L.) Scrib. (*Setaria verticillata* (L.) Beauv.) Verticillate Foxtail-grass.— Erect or decumbent, more or less branched, tufted stems; smooth sheaths; flat blades roughened above; and small, 1-seeded spikelets in a dense, greenish, terminal, spike-like panicle that is somewhat branched and interrupted at the base. Each spikelet has 1-3 persistent, downwardly barbed bristles at the base. The 1-nerved, outer empty glume is less than half as long as the spikelet, the inner one is 5-7-nerved; the parchment-like fertile lemma is faintly transversely wrinkled. The grain is free but enclosed in the flowering glumes.

Annual introduced from Europe; propagated by seeds. Flowering period: midsummer to midfall.—In gardens, yards, fields, and waste ground; less abundant in Ohio than the other foxtail-grasses.

Control.—Prevent seed production. See control measures given for green foxtail-grass.

18. ***Chaetochloa viridis** (L.) Scrib. (*Setaria viridis* (L.) Beauv.) Green Foxtail-grass. Green Foxtail.— Erect or ascending, simple or branched, tufted stems; smooth sheaths; dark green blades, usually roughened above as well as on the margins; and small, elliptic, 1-seeded spikelets in a rather thick, spike-like panicle tapered at the tip. Each spikelet is exceeded by a cluster of 1-3 slender, upwardly barbed, green or yellowish bristles. The outer empty glume is less than ½ the length of the spikelet; the 5-nerved inner one is as long as the spikelet; the blunt, ridged, moderately curved, fertile lemma is faintly transversely wrinkled.

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[1]The kind, rate, and time of application of lawn fertilizers suitable for Ohio conditions, as well as important information relative to the establishment and maintenance of a good lawn, are discussed in Ohio Agricultural Experiment Station Special Circular 18 under the title of Better Lawns. A copy may be secured upon request.

Fig. 3

a. **Panicum capillare** (Tumble Panic-grass)
b. **Echinochloa crus-galli** (Common Barnyard-grass)
c. **Chaetochloa viridis** (Green Foxtail-grass)
d. **Syntherisma sanguinale** (Large Crab-grass)

Annual naturalized from Europe; propagated by seeds which will remain viable in moderately dry soils over a period of several years and germinate irregularly as they are brought near the surface by tillage operations. Flowering period: midsummer to the end of the season.—Often a bad weed in cultivated fields, gardens, grainfields after harvest, and in waste places; it sometimes occurs in lawns and meadows.

Control.—Methods of control for heavily seeded, tillable land must not only prevent seed production by the current crop but also induce the germination of buried seeds followed by destruction of the resultant seedlings.

Hand methods are satisfactory for gardens and lawns; infested fields should receive thorough, frequent, clean cultivation continued as late as possible and supplemented by hand methods after the crop has been laid by. Surface cultivation after the removal of infested grain or other crops is advisable to induce fall germination. Discing will cover the seeds and the young plants may be plowed under or left till frost. A cultivated crop should follow the next season. Waste land should be mowed before the seeds ripen or, if neglected past that stage, should be burned over. Seeding down to legumes or grasses is helpful because numerous seeds will be rotted before the land is broken again. Sheep will destroy plants that come up late in the season after a meadow has been mowed.

19. ***Chaetochloa glauca** (L.) Scrib. (*Setaria glauca* (L.) Beauv.) Yellow Foxtail-grass. Yellow Foxtail.— Erect or ascending, flattened stems, branched at the base; smooth, flattened sheaths; rather wide, flat, often twisted blades covered with a light bloom; and small, oval, 1-seeded spikelets in a thick, blunt, spike-like panicle. Each spikelet is much exceeded by a cluster of 5-16 upwardly barbed, yellowish-brown bristles. The 1-3-nerved, outer empty glume is somewhat shorter than the 5-nerved, inner one; the strongly curved, fertile lemma is ribbed and transversely wrinkled.

Annual naturalized from Europe; propagated by seeds. Flowering period: midsummer to the end of the season.—In cultivated fields especially after the crop has been laid by, grainfields after harvest, gardens, lawns, meadows, pastures, and waste ground; general distribution in Ohio.

Control.—Prevent seed production. See control measures given for green foxtail-grass.

20. **Chaetochloa italica** (L.) Scrib. (*Setaria italica* (L.) Beauv.) Italian Millet. Hungarian-grass. German Millet. Millet.— Erect, frequently tall stems; smooth or rough sheaths; long, wide, generally rough blades; and elliptic spikelets in long, thick, compact, nodding, compound panicles, often interrupted at the base. Each spikelet is exceeded by a cluster of 1-3 upwardly barbed, purplish or yellowish-purple bristles. The 1-3-nerved, outer empty glume is less than ½ the length of the spikelet, the 5-7-nerved inner one is as long as the spikelet; the moderately curved, fertile lemma is both ribbed and finely transversely wrinkled.

Annual introduced from the Old World and escaped from cultivation; propagated by seeds. Flowering period: midsummer to midfall.—In cultivated fields and waste places; rather general distribution in Ohio but less prevalent and troublesome than the other foxtail-grasses.

Control.—Prevent seed production. See control measures given for green foxtail-grass.

Notes.—When fed too frequently or in large quantities, the hay is injurious to horses.

21. ***Cenchrus pauciflorus** Benth. (*Cenchrus tribuloides* L. and *C. carolinianus* Walt.) Sandbur-grass.— Solid, flattened, erect, ascending or trailing, much-branched, often mat-forming stems; loose, flattened, hairy-margined sheaths, the upper ones often partly enclosing the burs; smooth, narrow, flat or rolled blades; and small clusters of several spikelets enclosed in rounded burs that are covered with downwardly barbed prickles and arranged in stout, spike-like clusters. The unequal empty glumes are shorter than the spikelet; the parchment-like, fertile lemma encloses the free grain.

Native annual, propagated by seeds. Flowering period: midsummer to midfall.—In cultivated fields, pastures, waste ground, and along lake shores and railroads; mostly restricted to light, well-drained, sandy or gravelly soils; in Ohio it is prevalent along the lake shore and in the northwestern counties.

Control.—Prevent seed production. On small areas hoeing, hand-pulling, or burning is practicable. Clean cultivation until late in the season is satisfactory. Large areas should be burned over and put under cultivation; waste areas should be cleaned up.

Notes.—The sharp, stiff spines on the burs make it a very disagreeable weed to both man and animals. The seeds are readily distributed by the clinging burs on clothing, wool, or hair of animals and by blowing sand. The burs are removed with difficulty from the fleeces of sheep. The spines on the burs have been known to cause swelling and ulcers in the mouths of grazing animals.

22. **Holcus halapensis** L. (*Sorghum halapense* (L.) Pers.) Johnson-grass.— Smooth, solid, stout, tall, erect, simple or sometimes branched stems; smooth sheaths; smooth, long, broad, flat blades; and spikelets arranged in groups of 2 or 3 on the whorled, spreading branches of the large, open panicle. Each group of spikelets is composed of a sessile, broadly lance-shaped, appressed-hairy, central spikelet with hardened, usually purplish empty glumes and a membranous lemma tipped with a more or less bent awn, as well as 1 or 2, stalked, staminate or empty spikelets with membranous glumes. The grain is free but more or less enclosed in the flowering glumes.

Perennial introduced from Europe; escaped from cultivation in some counties of Ohio; propagated by seeds and by long, stout, creeping, underground stems. Flowering period: midsummer to midfall.—In cultivated fields and waste places.

Control.—On large areas the following procedure in the South, where this grass is a troublesome weed, has proven satisfactory. Turn the infested field into meadow or pasture and prevent seed production by mowing or grazing for one or more seasons. By this method few underground stems are produced and they are near the surface. Plow only deep enough to expose the underground stems and plant a cultivatd crop. Remove scattered plants with a hoe. Prevent seed production on waste ground by cutting or hoeing.

Notes.—This grass is valuable for forage but the difficulty of eradication and tendency to spread outweigh its good qualities. The abundant seeds are disseminated readily in hay or manure because the thick glumes protect them from unfavorable climatic conditions and they frequently pass unharmed through the digestive tracts of animals. The underground stems are often carried on farm implements or the hoofs of animals.

Under certain conditions this grass is extremely poisonous, due to the action of an enzyme on a glucoside, producing hydrocyanic acid as one product. This acid is apt to be formed in green but wilted or frosted plants, as well as stunted and second-growth plants. Dried plants are not dangerous.

23. **Andropogon virginicus** L. Virginia Beard-grass. Broom-sedge.— Smooth, slender, rather tall, erect, tufted stems, sparingly branched toward the top; sheaths smooth except along the margins; narrow, long-pointed, rough-margined blades, usually with stiff hairs on the upper surface near the base; and spikelets in pairs at the joints of the 2-3 slender, silky-hairy, spike-like flower branches which are enclosed at first but later protude from the sheath. The sessile spikelet of each pair has nearly equal, hardened, empty glumes, a colorless first lemma and a membranous, long-awned, fertile lemma; the stalked spikelet is reduced to a minute scale or is wanting. The small, yellowish, oat-shaped grain is free from the flowering glumes. The brownish-yellow color of the ripening plants makes them easily visible among other grasses.

Native perennial, propagated by seeds. Flowering period: late summer and early fall.—In dry or moist open fields and hillsides; most abundant and troublesome in old permanent pastures of southeastern Ohio.

Control.—Prevent seed production by cutting previous to bloom. Burning is advisable in fields where ripe seed has been scattered, followed by a cultivated crop the next season to destroy the roots. Include legumes in the rotation whenever possible in order to enrich the soil and promote a good growth of crop plants. Grubbing is satisfactory for small, newly infested areas.

Notes.—The seeds are widely disseminated because of the tuft of fine hairs at the base of the inflorescence. This grass tends to crowd out more valuable grasses in permanent pastures and is valueless for grazing except during the early summer.

LILIACEAE. Lily Family

24. ***Allium vineale** L. Field Garlic. Wild Onion. Wild Garlic.— Smooth, slender, flexuous, simple stem, leafy to about the middle, growing from a small ovoid bulb with membranous coats; several, round, hollow, thread-like leaves, grooved on the upper side; and small, slender-stalked, white, pink, purple, or greenish flowers in a head-like terminal cluster subtended by 2 or 3 lance-shaped, papery, early deciduous bracts. Each flower is composed of 6 narrowly oval segments. The flower is usually replaced by a small aerial bulblet that resembles a grain of wheat tipped with a long thread-like appendage. The fruit, when present, is a small 3-lobed capsule that contains black seeds. This plant has a strong garlicky odor.

Perennial introduced from Europe; propagated by underground, soft-shelled bulbs and hard-shelled bulblets, as well as by aerial bulblets. Wild garlic seldom produces seed except in the southern limit of its range and there is no record of seed production in Ohio. This

Fig. 4
Allium vineale (Field Garlic)

plant is disseminated by aerial bulblets in hay and grain, threshing machines, manure, on the feet of animals, and by the overflow of streams. The underground bulbs may be disseminated by farm tools, as well as with sod or on the roots of nursery stock. The aerial bulblets ripen in June or July after the spring flowering period. It is a weed in pastures, cultivated fields, grainfields, meadows, and waste places; wild garlic is found chiefly in the southern half of Ohio.

Control.—Consult the section on methods of control and eradication for certain noxious perennial weeds.

Notes.—Wild garlic is rated as a noxious weed for the following reasons: Flour is tainted when even a small number of the aerial bulblets are ground with wheat, and the grower suffers dockage because of the added cost of artificial drying that is necessary before the bulblets can be removed by cleaning. The milk, butter, and cheese produced from cows grazed in pastures that contain wild garlic are very frequently unsalable because of the garlicky flavor and odor imparted to them. Milk cows must be removed from a garlic-infested pasture 4-5 hours before milking to avoid tainted milk.

25. **Ornithogalum umbellatum** L. Star-of-Bethlehem.— Smooth, slender, erect, simple, tufted stems growing from a coated bulb; solid, fleshy, blunt, narrowly linear leaves, light green on the midrib, about as long as the stem; and small, bracted, greenish-white flowers on slender, ascending stalks, forming an open terminal cluster. Each flower is composed of 6 oblong, lance-shaped segments. The fruit is a small, 3-sided, nearly globose capsule containing black seeds.

Biennial introduced from Europe; propagated by seeds. Flowering period: spring and early summer.— Formerly cultivated for ornament but has escaped to lawns, meadows, fields, roadsides, and waste places; reported chiefly from the central and western counties of Ohio.

Control.—The bulbs of scattered plants should be dug, allowed to dry, and burned. Larger areas should be hoed or cultivated at intervals to prevent seed production and starve out the bulbs.

Class, DICOTYLAE. Dicotyls

RANUNCULACEAE. Crowfoot Family

26. **Ranunculus abortivus** L. Kidney-leaf Crowfoot. Small-flowered Crowfoot.— Smooth, slender, erect, branched, hollow stem; alternate, long-petioled, thick, rounded, heart-shaped or kidney-shaped basal leaves with scalloped margins; short-petioled or sessile stem leaves, palmately cut into several linear or wedge-shaped lobes; and small, pale yellow flowers, the oblong petals of which are shorter than the sepals. The fruits, each tipped with a minute curved beak, are borne in globose heads.

Native biennial, propagated by seeds. Flowering period: spring and summer.—Often a common weed in pastures, cultivated fields, meadows, strawberry beds, along roadsides, and in waste places; most frequent in damp soils; general and abundant in Ohio.

Control.—Improved drainage; prevent seed production. Early grubbing, hoeing, or close cutting is satisfactory for scattered plants, and cultivation for badly infested tillable fields. A close mowing during early bloom, followed by a second cutting during late summer, will keep this weed under control in permanent pastures and waste ground.

27. **Ranunculus sceleratus** L. Celery-leaf Crowfoot. Cursed Crowfoot.— Smooth, stout, freely branched, hollow stem; long-petioled, heart-shaped but three-parted basal leaves with the divisions again lobed; short-petioled or sessile stem leaves cut into several wedge-

shaped or linear lobes; and numerous, small, pale yellow flowers. The petals and sepals are nearly equal. The fruits, each tipped with a minute blunt beak, are borne in cylindrical heads.

Native perennial, propagated by seeds. Flowering period: spring and summer.—Sometimes in wet meadows and pastures, as well as abundant along ditches, creeks, or ponds; general distribution in Ohio.

Control.—Prevent seed production by hand digging or close cutting during early bloom.

Notes.—The acrid, poisonous sap of this plant will cause a painfal blister when applied to the skin and inflammation of the mouth and digestive tracts of grazing animals. Generally, animals avoid this plant but sometimes eat it accidentally or when vegetation is sparse during early spring. The volatile toxic compound is lost when the plant is dried and so it is harmless in hay. The tall buttercup and kidney-leaf crowfoot are less harmful since they contain less of the toxic compound which disappears upon drying.

28. ***Ranunculus acris** L. Tall Buttercup. Tall Crowfoot.— Hairy, slender, erect, hollow stem, branched at the top; long- and slender-petioled, palmately divided, basal leaves with the divisions again freely cleft into narrow, mostly pointed lobes; short-petioled, generally 3-parted stem leaves; and numerous, showy, bright yellow flowers. The wedge-shaped petals are longer than the sepals. The flattened fruits, each tipped with a short beak, are borne in globose heads.

Perennial introduced from Europe; propagated by seeds. Flowering period: late spring to early fall.—In moist soils of pastures, meadows, roadsides, and waste places. It is quite abundant in moist pastures of northern Ohio; rather general distribution except in southern Ohio.

Control.—Improved drainage. Prevent seed production by hand digging, cultivation, or close cutting. Consult the control measures given for kidney-leaf crowfoot.

BERBERIDACEAE. Barberry Family

29. ***Berberis vulgaris** L. Common Barberry. European Barberry.— Tall, erect shrub with grayish bark, yellowish wood, and bright yellow roots; thick, smooth, green or purple leaves with saw-toothed margins, grouped in the axils of 3-pronged or sometimes single, yellowish spines; and small yellow flowers in currant-like clusters. The stamens are sensitive at the base. The red, oblong berries are tart to the taste when ripe.

Perennial naturalized from Europe; propagated by seeds. The seeds are carried to uninfested areas yearly by birds. Flowering period: late spring and summer; fruits and seeds ripen during late summer and early fall, remaining on the bushes until winter.—Escaped from cultivation as ornamental shrubs or from plantings by early settlers to fence-rows, permanent pastures, thickets, woodlots, and roadsides. This shrub was formerly of rather general distribution in Ohio with the largest number of escaped bushes in the northeastern counties, but during the past few years a large proportion of cultivated and escaped bushes have been located and destroyed.

Control.—Chemical eradication by the use of crushed rock salt or kerosene. A bush with a clump of stems approximately one foot in diameter should receive 20 pounds of crushed rock salt; a larger or smaller bush or clump should receive a proportionate quantity. The salt should be poured into the clump, piled around the stems, and spread for at least 6 inches around the edge of the clump to insure killing of underground shoots. One gallon of kerosene is recommended for a medium-sized bush. Salt is somewhat preferable because it kills more rapidly than kerosene. Digging is advisable only when the bushes are growing near valuable shrubbery that would be killed by a chemical application.

Notes.—The common or European barberry is the alternate host of the fungus that causes the destructive black stem rust of wheat, oats, rye, barley, and several cultivated grasses. As such it is a menace to all cereal crops. The intensive eradication campaign that is in progress against the common barberry in Ohio as well as other grain-growing states should receive the hearty aid and co-operation of all landowners.

PAPAVERACEAE. Poppy Family

30. **Papaver dubium** L. Corn Poppy. Field Poppy.— Bristly-hairy, slender, branched stem; alternate, petioled, lower leaves and smaller, nearly sessile, upper ones, all pinnately divided into oblong, pointed lobes; and regular, showy, scarlet flowers on long, nodding stalks. The oblong to club-shaped fruits are narrowed below and open near the top by pores. This plant has milky sap.

Annual introduced from Europe; propagated by seeds. Flowering period: summer months.—A weed of cultivated fields, meadows, and waste ground; rare in Ohio.

Control.—Prevent seed production by destroying the plants previous to bloom. Plants with partly ripe seeds should be collected and burned.

Notes.—This weed is objectionable because of the large number of seeds produced. The bitter taste of the plants makes them particularly objectionable in hay.

BRASSICACEAE. MUSTARD FAMILY. CRUCIFERS

31. **Draba verna** L. Vernal Whitlow-grass.— Small, mostly oblong, toothed or entire, tufted, basal leaves covered with stiff, forked hairs; numerous, smooth, short, slender, leafless, flowering stems bearing small, closed, white flowers on ascending stalks. The petals are 2-cleft. The small, smooth, oblong or oval, flattened pods are shorter than their stalks.

Annual or winter annual introduced from Europe; propagated by seeds. Flowering period: early to late spring.—In fields, lawns, along roadsides, and in waste places; reported chiefly from the southern counties of Ohio.

Control.—Prevent seed production by close cutting, hoeing, or clean cultivation during early spring. Raking followed by mowing is helpful in lawns. Badly infested areas should receive surface cultivation during late summer and fall. Sheep are an aid in keeping down this weed in permanent pastures.

32. **Draba caroliniana** Walt. Carolina Whitlow-grass.— Small, obovate, mostly entire, tufted, basal leaves beset with forked hairs; short, smooth or slightly hairy, flowering stems, leafy near the base and bearing small, white flowers on short stalks clustered near the top. The petals are entire. The small, smooth or appressed-hairy, linear, flattened pods are longer than their stalks.

Native annual or winter annual, propagated by seeds. Flowering period: spring and early summer.—In fields, lawns, and waste places; especially prevalent on sandy soils; reported from several counties of Ohio.

Control.—Same methods as for vernal whitlow-grass.

33. **Camelina sativa** (L.) Crantz. Common False-flax.— Erect stem, simple or branched above; alternate, lance-shaped leaves, the lowest ones petioled, entire or obscurely toothed; the upper leaves sessile, mostly entire, clasping by an arrow-shaped base; and numerous, small, yellow flowers in open, elongated, terminal clusters. The pear-shaped, slightly margined pods are tipped with a slender, persistent style and borne on wiry, spreading stalks. The plant is either smooth or lightly beset with forked or star-shaped hairs.

Annual or winter annual introduced from Europe; propagated by seeds, which become mucilaginous when wet and are readily distributed by animals and farm implements. Flowering period: summer months.—In grainfields, meadows, along roadsides, and in waste places; reported from several counties of Ohio.

Control.—Prevent seed production. Hand-pulling or hoeing is satisfactory for scattered plants in grain and cultivated crops; spring weeding is advisable for heavily infested grainfields. Plants with partly mature pods should be burned; the stubble should be burned over in case mature heads have fallen and should be followed by surface cultivation to induce fall germination. A cultivated crop should be planted the next season. Avoid winter grain crops until the weed is brought under control; a heavy stand of alfalfa for a smother crop will help to bring about control. Infested waste areas should be mowed previous to bloom.

34. ***Bursa bursa-pastoris** (L.) Britt. (*Capsella bursa-pastoris* (L.) Medic.) Shepherd's-purse.— Erect, branched stem; more or less pinnately lobed basal leaves arranged in a rosette; alternate, sessile, lance-shaped, slightly toothed or entire stem leaves, clasping by a pair of ear-like lobes; and very small, white flowers in open, elongating, terminal clusters. The triangular, flattened pods are straight or notched at the apex and are borne on slender, ascending or spreading stalks. The leaves and lower part of the stem are lightly covered with forked or star-shaped hairs.

Annual or winter annual naturalized from Europe; propagated by seeds, a large number being produced by each plant. The seeds become mucilaginous when wet. Buried seeds of shepherd's-purse, in common with other weeds of the mustard family, remain viable for a number of years and will grow when brought near the surface during cultivation. The prolific, succulent growth of this plant tends to crowd out crop plants and robs them of a normal water supply. Flowering period: more or less continuous from spring to late fall.—In cultivated fields, grainfields, gardens, thin meadows and pastures, dooryards, along roadsides, and in waste places; general and abundant in Ohio; a common weed in the cultivated areas of the world.

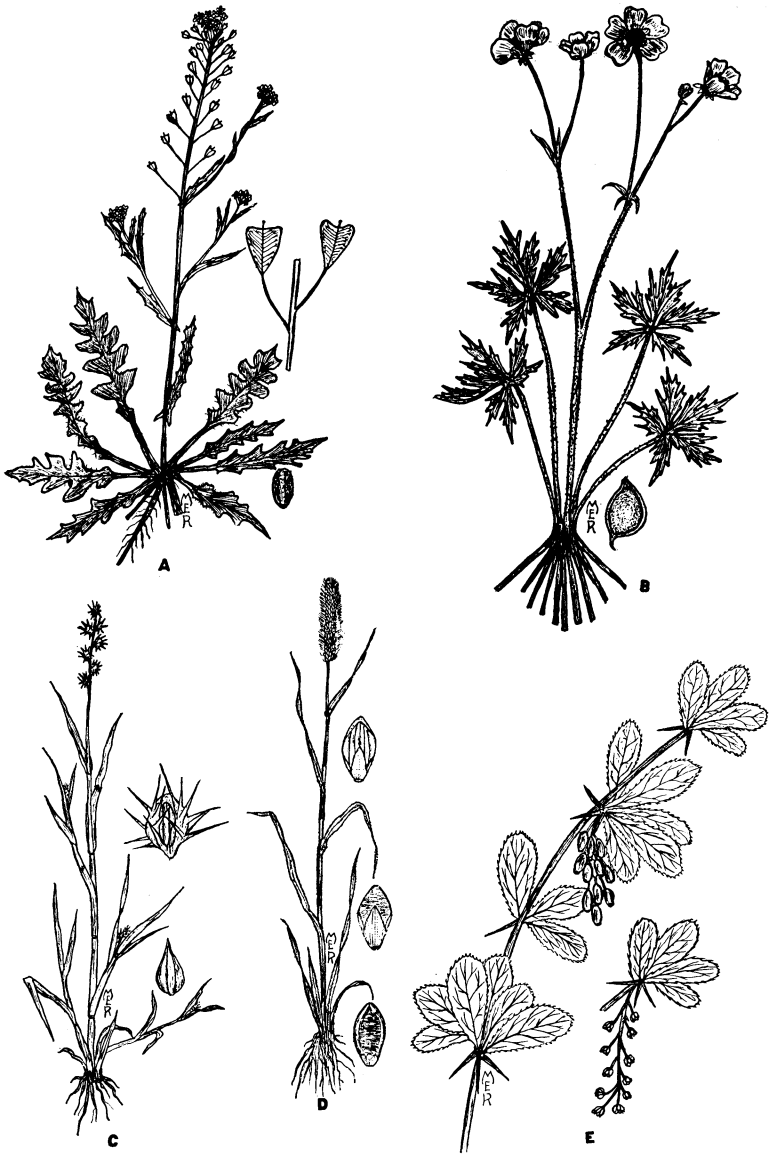

Fig. 5

a. **Bursa bursa-pastoris** (Shepherd's-purse)
b. **Ranunculus acris** (Tall Buttercup)
c. **Cenchrus pauciflorus** (Sandbur-grass)
d. **Chaetochloa glauca** (Yellow Foxtail-grass)
e. **Berberis vulgaris** (Common Barberry)

Control.—Prevent seed production from spring to the end of the growing season. Hand-pulling or hoe-cutting below the crown is satisfactory for small patches or scattered plants; badly infested fields should receive clean cultivation. The seed bed should be prepared early in the spring and the crop cultivated as late in the season as possible. After harvest the field should be given repeated surface cultivation to induce autumn germination and to destroy the resultant seedlings; spring weeding is advisable in badly infested grainfields. Waste land should be mowed frequently enough to prevent seeding. Heavy stands of legumes or grasses are valuable as smother crops.

Young plants may be killed by a spray of iron sulphate.

35. **Radicula palustris** (L.) Moench. (*Roripa palustris* (L.) Bess.) Marsh Yellow-cress. Marsh Cress.— Smooth, erect, branched stem; smooth, alternate leaves, the lower ones petioled, oblong, deeply pinnately divided into toothed or wavy-margined lobes; the upper leaves toothed or slightly lobed, on very short, dilated, often clasping petioles; and very small, yellow flowers. The small, oblong pods are tipped with a minute, persistent style and are borne on slender, spreading stalks.

Native annual, winter annual, or biennial, propagated by seeds. Flowering period: late spring and summer.—A weed of cultivated crops, spring grains, meadows, and waste land; most troublesome in poorly drained soils or during a wet season; general distribution in Ohio.

Control.—Drainage of wet areas. Prevent seeding by hand methods or by clean cultivation. Soybeans sown in corn help as a smother crop. Fall cultivation will destroy autumn seedlings; thorough preparation of the seed bed will control it in spring grains.

A spray of iron sulphate has been found effective for holding this weed in check.

36. ***Lepidium campestre** (L.) R. Br. Field Peppergrass.— Erect stem with branches at the top; alternate leaves, the basal ones petioled, spatula-shaped, tufted; the stem leaves sessile, arrow-shaped, entire or slightly toothed, clasping by ear-like lobes; and very small, numerous, white flowers in dense, elongated, terminal clusters. The flower has 6 stamens. The ovate, stout-stalked pods are broadly winged above and the notched apex is tipped with a minute style. This plant is usually covered with white, scale-like hairs and the leaves are granular-viscid on the lower side.

Annual or winter annual introduced from Europe; propagated by seeds. Several stems are formed on one root and the plant sometimes breaks off forming a tumbleweed. Flowering period: midspring to midsummer.—In pastures, old meadows, grainfields, cultivated fields, gardens, yards, and waste places; rather general distribution in Ohio.

Control.—Prevent seed production. Hand methods are satisfactory for scattered plants; early spring preparation of the seedbed and clean cultivation are advisable for heavily seeded, tillable land to prevent seeding of the winter annual crop of plants. Surface cultivation after the harvest of a heavily infested grain crop will destroy the autumn crop of seedlings; infested meadows should be cut before the seeds mature; waste areas should be mowed.

In situations where other methods are impracticable this weed may be checked by a spray of iron sulphate.

37. **Lepidium virginicum** L. Virginia Peppergrass.— Erect, smooth or slightly hairy stem with numerous, ascending branches; alternate, nearly smooth leaves, the basal ones petioled, pinnately divided into a large terminal lobe and small lateral ones, all toothed; the stem leaves short-petioled to sessile, lance-shaped or narrowly oblong, toothed or entire; and very small, numerous, white flowers in dense, elongated, terminal clusters. The flower has 2 stamens. The round, slender-stalked pods are slightly winged above and the notched apex is tipped with a minute style.

Native annual and winter annual, propagated by seeds; frequently breaks off and forms a tumbleweed. Flowering period: spring to fall.—A common weed in grainfields, meadows, cultivated fields, gardens, yards, along roadsides, and in waste places; especially troublesome in fertile clover meadows; general and abundant in Ohio.

Control.—Same methods as for field peppergrass and shepherd's-purse.

Notes.—Birds relish the seeds and the plants are often disseminated in this way. Prepared mixtures for feeding caged birds may contain the seeds.

38. **Thlaspi arvense** L. Field Penny-cress.— Smooth, erect stem, simple or branched above; alternate, slightly toothed leaves, the basal ones wing-petioled, inversely lance-shaped, tufted; oblong to lance-shaped stem leaves, the lower ones sessile but the upper clasping the stem by ear-like lobes; and very small, white flowers in dense, elongated, branched, terminal clusters. The large, nearly round, broadly winged, flattened pods are notched at the top and are borne on wiry, slender, ascending stalks. This plant has a garlicky odor when crushed.

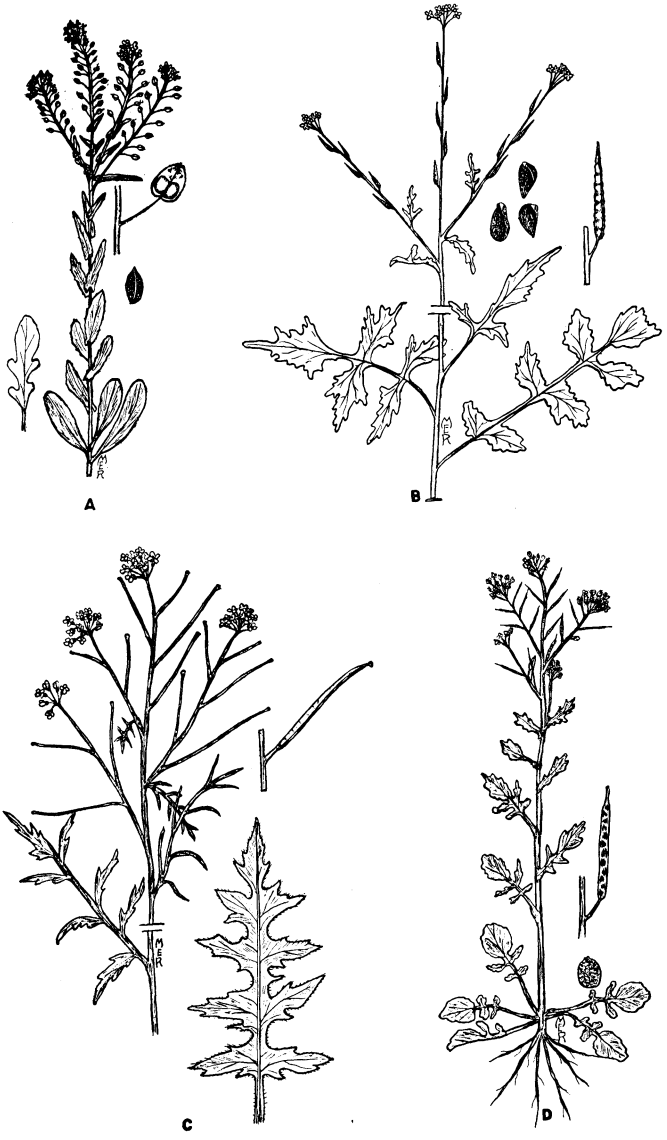

Fig. 6

a. **Lepidium campestre** (Field Peppergrass)
b. **Erysimum officinale** (Hedge-mustard)
c. **Norta altissima** (Tall Hedge-mustard)
d. **Barbarea barbarea** (Yellow Winter-cress)

Annual or winter annual introduced from Europe; propagated by seeds. A large number of seeds are produced that remain viable a long time when buried in the soil; germination is uneven. The plants are not easily winter-killed, and plants bearing partly mature pods will ripen seed after they are plowed under. Flowering period: more or less continuous from late winter to late autumn; ripe seeds from autumn plants by midsummer and from spring plants somewhat later.—In grainfields, meadows (especially clover), along roadsides, and in waste places; common locally in some of the northwestern counties, especially on sandy soils, and has been introduced into several other counties. Field penny-cress is a common and serious weed in the northwestern states, and it is a common impurity in hay, grain, and crop seeds from that region.

Control.—Prevent seed production throughout the season. Hand-methods will suffice for scattered plants, which should be burned in case the pods are partly mature. Badly infested fields should be put under cultivation for a season or longer, whenever possible; spring weeding is of value for infested, winter grains, as well as fall discing, supplemented by later surface cultivation or plowing to destroy the seedlings. Early spring cultivation and a tilled crop should follow; a forage crop, such as alfalfa, is of value provided it is mowed frequently enough. Mowing of waste land at frequent intervals throughout the season is necessary to prevent reinfestation.

Notes.—The garlicky odor of the foliage may be imparted to dairy products or mutton when eaten by grazing animals, and flour is ruined when the seeds are milled with wheat.

39. **Cheirinia repanda** (L.) Link. (*Erysimum repandum* L.) Repand Cheirinia. Spreading Mustard.— Hairy, stout, branched stem; alternate, sessile or short-petioled, lance-shaped, wavy-toothed leaves covered with appressed, 2-branched hairs; and small, yellow flowers in elongated, terminal clusters. The long, slender, 4-sided pods are borne on stout, spreading stalks.

Annual and winter annual introduced from Europe; propagated by seeds. Flowering period: spring and summer.—In cultivated and waste ground; reported from several counties.

Control.—Prevent seed production by hand-pulling before bloom. Burn plants that bear partly mature pods. Clean cultivation is advisable for badly infested fields.

40. **Erysimum officinale** L. (*Sisymbrium officinale* (L.) Scop.) Hedge-mustard.— Tall, slender, erect stem with stiff, spreading branches; alternate, petioled to almost sessile leaves, pinnately divided into toothed lobes; and small, yellow flowers in rather flat-topped, elongated, terminal clusters. The small, stalked, awl-shaped pods are closely pressed against the stem. This plant is usually covered with rather long, stiff, scattered hairs.

Annual or biennial introduced from Europe; propagated by seeds. Flowering period: late spring to fall.—A common and unsightly weed in gardens, fields, vacant lots, waste ground, and along roadsides; seldom serious in cultivated ground; general and abundant in Ohio.

Control.—Prevent seed production during the long flowering period by frequent hand-pulling, hoe-cutting below the crown, close mowing, or clean cultivation.

41. ***Norta altissima** (L.) Britt. (*Sisymbrium altissimum* L.) Tall Hedge-mustard. Tumbling Mustard.— Smooth, erect, much branched stem; alternate, generally smooth leaves; the lower ones petioled, pinnately divided into wavy-toothed, oblong or lance-shaped lobes; the upper leaves short-petioled or sessile, smaller, deeply pinnately divided into lance-shaped or linear lobes; and small, pale yellow flowers in elongating, terminal clusters. The long, round, linear pods are borne on short, spreading stalks. This plant has a decided cress taste.

Annual or winter annual introduced from Europe; propagated by seeds. Each plant produces a very large number of seeds. The brittle stems are broken off during early autumn and the plant becomes a tumbleweed. The tough pods break irregularly during the winter months and the seeds are scattered in small numbers over a wide area as the plants are carried about by winds. Flowering period: summer months.—A weed of grainfields, roadsides, waste ground, and along railroads. It is seldom serious in cultivated land. Neither as general nor abundant as hedge-mustard in Ohio. Baled hay or seeds from the Northwest may carry the weed as it is troublesome in that section.

Control.—Prevent seed production. Hand-pulling or hoe-cutting before bloom is satisfactory for scattered plants; badly infested fields should be put under clean cultivation. Prevent seeding in infested meadows by early close mowing; spring weeding is necessary in badly infested grainfields, supplemented by surface cultivation after harvest. Waste ground should be mowed.

42. **Conringia orientalis** (L.) Dum. Hare's-ear Mustard. Treacle Mustard.— Smooth, generally erect, simple stem; alternate, sessile, smooth, entire, light green leaves, ovate, oblong, or ellipse-shaped, blunt, somewhat clasping by ear-like basal lobes; and small, creamy-yellow flowers in terminal clusters that are greatly elongated in fruit. The long, linear, 4-angled pods are borne on slender, spreading stalks. This plant is covered with a cabbage-like bloom.

Annual and winter annual introduced from Europe; propagated by seeds which become mucilaginous when wet and are readily disseminated on the feet of animals and by farm implements. Flowering period: summer and early fall.—In grainfields, waste ground, along roadsides, and railways. Reported from several northern Ohio counties. A troublesome weed in grainfields of the northwestern states.

Control.—Prevent seed production. Hoeing out autumn seedlings and hand-pulling previous to or during first bloom are satisfactory for scattered plants. In case pods are formed the plants should be burned. Badly infested fields should be put under clean cultivation. This weed is kept down in grainfields by spring weeding and cultivation after harvest. Sheep readily eat this weed.

Notes—The succulent plants absorb a large amount of moisture from the soil. The plants may be used for salads and greens.

43. ***Barbarea barbarea** (L.) Mac M. (*Barbarea vulgaris* R. Br.) Yellow Winter-cress. Yellow Cress. Common Winter Cress.— Smooth, erect, angled, branched stem; smooth, alternate leaves, the basal ones petioled, tufted, pinnately divided into a large, rounded, terminal lobe, as well as 1-4 pairs of smaller lateral segments; the stem leaves similar but with a toothed, terminal lobe, sessile or short-petioled, frequently clasping the stem; and conspicuous, bright yellow flowers in terminal clusters. The numerous, slender, obscurely 4-angled, erect pods are borne on short, spreading stalks.

Mostly a biennial weed, but under favorable conditions it may be perennial by roots, introduced from Europe; propagated by seeds. Flowering period: spring and early summer.—A troublesome weed in meadows, grainfields, gardens, along roadsides, and in waste places; especially common on low ground and along streams that overflow; general distribution in Ohio.

Control.—Prevent seed production. Spudding or hoeing of autumn rosettes is satisfactory for scattered plants, as well as close cutting or hand-pulling of the flower-stalks during the spring previous to bloom. Plants in full bloom or past should be collected and burned because they will mature seeds.

Clean cultivation of a hoed crop following early plowing is recommended for large areas. Spring weeding is advisable for infested grainfields, supplemented by fall plowing and cultivation. Heavily infested meadows should receive an early mowing just low enough to clip the lowest flowers, so that the lower mowing at harvest will cut off any sprouted plants. An early mowing is essential for waste areas, and sometimes a second mowing is necessary. Sheep are a valuable aid in destroying this weed.

Notes.—The seeds are a common impurity in small agricultural seeds. The rosettes of autumn plants are frequently gathered for greens during the early spring.

44. ***Barbarea verna** (Mill.) Aschers. Early Winter-cress.— Similar to the preceding species except that the basal leaves have 4-8 pairs of lateral segments and the pale yellow flowers are smaller. The longer, sharply 4-angled, slightly flattened pods are borne on short, stout stalks.

Perennial introduced from Europe; propagated by seeds. Flowering period: spring and early summer.—In meadows, fields, along roadsides, and in waste places; less common in Ohio than yellow winter-cress.

Control.—Same methods as for yellow winter-cress.

Notes.—Sometimes cultivated as a salad plant.

45. ***Sinapis arvensis** L. (*Brassica arvensis* (L.) Ktz.) Corn Mustard. Charlock.— Erect stem with branches at the top; alternate, irregularly toothed or lobed leaves, the lower ones petioled, roughly oval in shape; the upper leaves narrower, sessile or nearly so; and showy, fragant, bright yellow flowers in elongating terminal clusters. The round, ribbed, smooth pods are borne on stout, ascending stalks; each pod is somewhat constricted between the seeds and is tipped by a long, flattened beak. The stem and leaves usually bear stiff, scattered hairs.

Annual introduced from Europe; propagated by seeds, which are produced in very large numbers and retain their vitality in the soil over a number of years. Flowering period: late spring to early fall.—A common and injurious weed in grainfields, especially in oats in

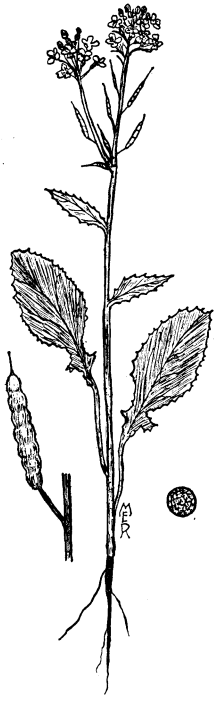

Fig. 7
Sinapis arvensis (Corn Mustard)

northern Ohio; it is sometimes troublesome in meadows, especially clover, as well as along roadsides and in waste ground; general distribution in Ohio except in the southern counties. The seeds are removed from crop seeds with some difficulty.

Control.—Prevent seed production. Hand methods are satisfactory for small areas; scattered plants in grainfields should be pulled out in the spring previous to bloom.

Spring weeding is advisable in heavily infested grainfields; weeding should be done while the mustard and grain plants are still small. This spring treatment should be supplemented by surface cultivation after harvest to stimulate fall germination of buried seeds. The resultant crop of fall seedlings may be destroyed by further surface cultivation, plowing, or grazing with sheep. Numerous small seedlings will be killed by frost. The infested field should be plowed early the following spring and the seedbed prepared for a cultivated crop, such as corn; early preparation permits surface cultivation at intervals previous to the planting of the crop, with attendant germination and destruction of seedling weeds. Cultivation of the hoed crop should be continued as late in the season as possible. Seeding down to legumes or grasses, as well as the use of summer smother crops, will aid in bringing this weed under control. Winter grains should be dropped from the rotation until control is attained or should be sown only on grassland or cornfields that were clean the previous season.

Early, close mowing of infested meadows as recommended for yellow winter-cress is profitable. Mowing before bloom or mowing supplemented by burning, in case pods are present, is essential along fence rows and roadsides, as well as on waste ground.

Iron sulphate, copper sulphate, and sulphuric acid have been employed as sprays to kill small plants in grainfields but, as a rule, the cost and trouble of application prevent their use except in extreme cases.

Notes.—This mustard draws heavily on the moisture and mineral supply of the soil thereby reducing yields in heavily infested grain crops.

46. *Brassica nigra (L.) Koch. Black Mustard.— Erect, often tall, freely branched stem, usually somewhat hairy below, but smooth above; alternate, stiff-hairy leaves, the lower ones petioled, pinnately divided into a large terminal lobe and several small lateral segments, all toothed; the upper leaves short-petioled to sessile, smaller, toothed or sometimes entire; and showy, bright yellow flowers in elongating terminal clusters. The short, linear, 4-sided pods are borne on very short, closely appressed stalks; each pod is tipped by a slender, conic beak.

Annual or biennial introduced from Europe; propagated by seeds. Flowering period: summer and fall.—A weed of grainfields, meadows, gardens, roadsides, and waste ground; most troublesome on fertile soils; general and abundant in Ohio.

Control.—Same methods as for corn mustard.

47. **Brassica juncea** (L.) Cosson. Indian Mustard.— Smooth, erect, generally stout, branched stem; alternate, smooth, pale green leaves, the lower ones long-petioled, pinnately divided into a large terminal lobe and smaller lateral segments, all coarsely toothed; the upper leaves mostly sessile, smaller, lance-shaped, generally entire; and showy, bright yellow flowers in elongating terminal clusters. The long, linear, 4-sided pods are borne on slender, ascending or spreading stalks; each pod is tipped by a long, awl-shaped beak. This plant is often lightly covered by a cabbage-like bloom.

Annual or biennial introduced from Asia; propagated by seeds. Flowering period: late spring and summer.—A weed of grainfields, roadsides, railways, and waste ground; a troublesome invader in grainfields, because of its early flowering period.

Control.—Same methods as for corn mustard, with the exception of selective sprays for grainfields.

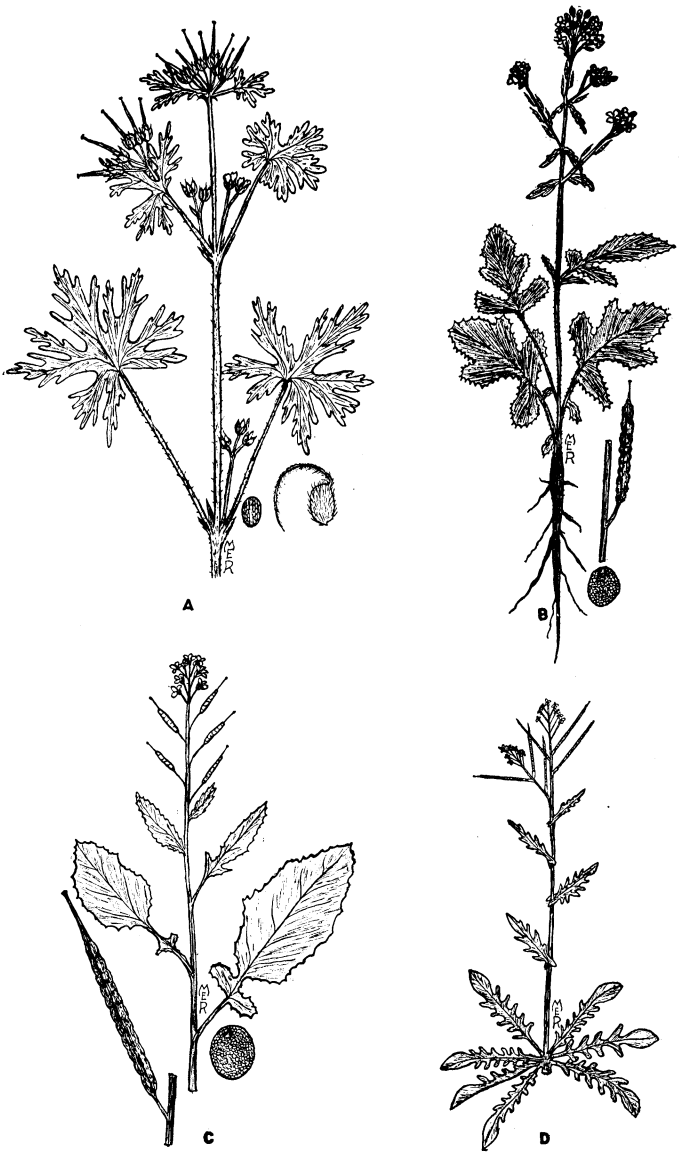

Fig. 8

a. **Geranium carolinianum** (Carolina Crane's-bill)
b. **Brassica nigra** (Black Mustard)
c. **Brassica juncea** (Indian Mustard)
d. **Barbarea verna** (Early Winter-cress)

GERANIACEAE. GERANIUM FAMILY

48. **Geranium carolinianum** L. Carolina Crane's-bill.— Grayish-hairy, rather stout, erect stem, generally branched both above and below; alternate, petioled, hairy, rounded kidney-shaped leaves, palmately divided into 5-9 toothed or lobed segments; and rather compact clusters of small, pale purple flowers borne on rather stout, 1-2-flowered stalks in the axils of the upper leaves. The 5 pointed, hairy-margined sepals are about as long as the 5 notched, wedge-shaped petals. The small, lobed, hairy fruit is tipped with a long, stout beak composed of the united, persistent styles.

Native annual or biennial, propagated by seeds. Flowering period: spring and summer.—In fields, lawns, and waste ground; flourishes in dry, unfertile soils; general distribution in Ohio.

Control.—Prevent seed production by hoeing, digging, hand-pulling, or mowing before bloom or by clean cultivation.

OXALIDACEAE. WOOD-SORREL FAMILY

49. **Oxalis stricta** L. (*Xanthoxalis stricta* (L.) Small.) Upright Wood-sorrel. Yellow Wood-sorrel. Sour-grass.— Low, slender, pale green, erect or decumbent stem with branches spreading from the base; alternate, palmately trifoliate leaves on slender petioles narrowly dilated at the base; smooth, inversely heart-shaped leaflets, closing when touched; and small, yellow flowers on rather long, forked, axillary stalks, forming open clusters. The 5 petals exceed the 5 hairy-margined, narrowly lance-shaped sepals. The fruit is an upright cylindrical capsule, abruptly narrowed at the apex, borne on a downwardly turned stalk. The stem, petioles, and flower-stalks are covered with appressed hairs. The plants that belong to this genus have sour sap.

Native annual or perennial, propagated by seeds and, if perennial, also by woody rootstocks. Flowering period: spring to fall.—In cultivated fields, meadows, pastures, lawns, roadsides, woods, and waste ground; flourishes in shady places; general distribution in Ohio.

Control.—Prevent seed production and destroy the rootstocks by hoeing or hand-pulling before bloom. Clean cultivation is satisfactory.

50. **Oxalis corniculata** L. (*Xanthoxalis corniculata* (L.) Small. *Oxalis repens* Thunb.) Procumbent Wood-sorrel. Yellow Procumbent Wood-sorrel. Lady's Sorrel.— Lightly hairy or nearly smooth stem, with creeping basal branches frequently rooting at the nodes; alternate, palmately trifoliate leaves on slender petioles dilated at the base; smooth, inversely heart-shaped leaflets, broader than long; and small, yellow flowers on forked, axillary stalks, forming open, 1-3-flowered clusters. The fruit is an oblong capsule, gradually narrowed to the apex, borne on an upwardly turned, appressed-hairy stalk.

Annual or perennial introduced from tropical America; propagated both by seeds and slender stolons or runners. Flowering period: early spring to late autumn or throughout the year in protected situations.—In fields, waste places, along roadsides, and often a common weed in and around greenhouses; reported from several counties of Ohio.

Control.—Same methods as for upright wood-sorrel.

51. **Oxalis grandis** Small. (*Xanthoxalis grandis* Small.) Great Wood-sorrel. Great Yellow Wood-sorrel.— Rather stout, erect, generally simple stem; alternate, petioled, palmately trifoliate leaves; rather large, deeply notched, usually brown-margined leaflets; and fairly large, yellow flowers on forked, axillary stalks, forming open clusters. The fruit is an erect, stout, ovoid or ovoid-oblong capsule borne on an erect or spreading stalk. The stem, petioles, and flower-stalks are loosely soft-hairy.

Native annual or perennial, propagated both by seeds and by more or less elongated rootstocks. Flowering period: late spring and summer.—In woods, waste ground, and along stream banks; general distribution in Ohio except in the northwestern counties.

Control.—Same methods as for upright wood-sorrel.

52. **Oxalis cymosa** Small. (*Xanthoxalis cymosa* Small.) Tall Wood-sorrel. Tall Yellow Wood-sorrel.— Erect, relatively tall stem, usually branched above; alternate, petioled, palmately trifoliate leaves; smooth, inversely heart-shaped leaflets, broader than long; and small, clustered, yellow flowers on forked, axillary stalks which are usually but little longer than the subtending petioles. The fruit is a cylindrical capsule, gradually narrowed to the apex. The stem and flower-stalks are usually covered with long, soft hairs.

Native annual or perennial, propagated both by seeds and by rootstocks. Flowering period: spring to fall.—In fields, meadows, lawns, and waste ground, especially in shaded places; general and abundant in Ohio.

Control.—Same methods as for upright wood-sorrel.

EUPHORBIACEAE. SPURGE FAMILY

53. **Acalypha virginica** L. Virginia Three-seeded Mercury.— Somewhat hairy, erect, simple or branched stem, often tinged with purple; alternate, long-petioled, mostly ovate, coarsely toothed, thin, dark green leaves covered with short, scattered hairs; and small, greenish, axillary flowers, the staminate ones in a loose, stalked, spike-like cluster above the carpellate flowers, both subtended by a deeply cleft, leaf-like bract. The fruit is a small, smooth or lightly hairy, 3-lobed capsule.

Native annual, propagated by seeds. Flowering period: summer and fall.—A common weed in barnyards, waste ground, fields (especially clover), along roadsides, and around buildings; especially abundant in moist, fertile soils; general distribution in Ohio.

Control.—Prevent seed production by cutting or hand-pulling before bloom. Badly infested fields should be planted to a cultivated crop.

54. **Poinsettia dentata** (Mx.) Small. (*Euphorbia dentata* Mx.) Toothed Spurge.— Branched, erect or ascending stem, somewhat woody at the base; mostly opposite, coarsely toothed, hairy leaves with prominent veins on the under side, varying in shape from ovate to nearly linear, narrowed to rather slender, hairy petioles; and small, apetalous flowers clustered at the ends of the stem and branches. Each flower is surrounded by a bell-shaped, lobed involucre that bears one or more short-stalked, yellowish glands. The fruit is a smooth, short-stalked capsule with 3 rounded lobes. This plant has milky sap.

Native annual, propagated by seeds. Flowering period: summer and fall.—In fields, meadows, and waste ground; especially prevalent in fertile soils; reported from a number of Ohio counties.

Control.—Prevent seed production either by hand-pulling, hoe-cutting, or mowing before bloom or by clean cultivation continued late in the season. Infested meadows should be harvested before the seeds are mature. Spring weeding and after-harvest cultivation are advisable for heavily infested grainfields.

55. **Tithymalus cyparissias** (L.) Hill. (*Euphorbia cyparissias* L.) Cypress Spurge.— Smooth, erect, branched, clustered stems, scaly below; small, smooth, linear, crowded, sessile leaves, alternate below but whorled beneath the inflorescence; and small, apetalous flowers in head-like, stalked, terminal clusters. Each flower is surrounded by a short-stalked, roughly top-shaped involucre bearing 4 crescent-shaped glands and subtended by pale green, heart-shaped bracts. The fruit is a small, short-stalked capsule with rounded, slightly roughened lobes; sap is milky or discolored.

A perennial introduced from Europe; propagated both by seeds and by tough horizontal rootstocks. The horizontal rootstocks form thick patches that choke out other plants. Flowering period: summer and early fall.—Formerly used as an ornamental in cemeteries, yards, and gardens but has escaped from cultivation to fields, roadsides, and waste places; general distribution in Ohio.

Control.—Prevent seed production and destroy or starve out the rootstocks. Repeated close cutting, grubbing, salting, and shallow plowing several times during the summer to expose the rootstocks are satisfactory methods of control. Sodium or calcium chlorate at a dilution of one pound to a gallon of water and applied at the rate of 3 pounds to the square rod during bloom has been effective against light stands of this weed.

56. **Chamaesyce preslii** (Guss.) Arth. (*Euphorbia nutans* Lag., *Euphorbia preslii* Guss.) Nodding Spurge.— Smooth or sparingly hairy, slender, erect or ascending, reddish stem with numerous, spreading branches; opposite, short-petioled or sessile, oblong, ovate, or somewhat sickle-shaped leaves with toothed or entire margins, the smooth, 3-nerved, inequilateral blades often with a red blotch in the center; and small, stalked, apetalous flowers borne at the tip of the stem and branches. Each flower is surrounded by a stalked, obovoid involucre bearing 4 glands subtended by white or red appendages. The fruit is a smooth, 3-lobed capsule. The sap is milky.

Native annual, propagated by seeds. Flowering period: late spring to early fall.—In fields, meadows, and waste places, as well as along paths and roadsides; flourishes in dry soils; general and abundant in Ohio.

Control.—Prevent seed production by hand-pulling or hoe-cutting before bloom or by clean cultivation of a hoed crop. Burning over the stubble after harvest will destroy numerous seeds in grainfields. Thin, infested meadows should be put under cultivation, fertilized, and reseeded.

Note.—The acrid, milky sap causes irritation of the skin and mucous membranes.

57. **Chamaesyce maculata** (L.) Small. (*Euphorbia maculata* L.) Spotted Spurge.— Slender, usually prostrate, reddish stem with radial, basal branches usually forming a mat; small, opposite, short-petioled, oblong or ovate, toothed or nearly entire, blunt leaves, inequilateral at the base, often with a brownish-red blotch in the center; and small, short-stalked, apetalous flowers solitary in the axils of the leaves. Each flower is surrounded by a short-stalked involucre bearing 4 glands subtended by narrow, white or red appendages. The fruit is a hairy, 3-lobed capsule. This plant is finely hairy and contains milky, irritating sap.

Native annual, propagated by seeds. Flowering period: summer and fall.—In fields, gardens, dooryards, and waste places, as well as along walks and roadsides; grows readily in dry, unfertile soils; rather general distribution in Ohio.

Control.—Same methods as for nodding spurge.

Note.—The milky sap causes irritation of the skin and mucous membranes.

MALVACEAE. Mallow Family

58. **Malva rotundifolia** L. Roundleaf Mallow. Cheeses. Running Mallow.— Somewhat hairy, procumbent stem with spreading basal branches; alternate, long- and slender-petioled, slightly lobed, rounded kidney-shaped leaves with wavy-toothed margins; and rather small, pale blue or whitish flowers in axillary clusters. The 5 inversely heart-shaped petals are longer than the 5 ovate, pointed calyx-lobes. The fruit is composed of kidney-shaped carpels arranged in a circle, but separating at maturity.

Annual or biennial introduced from Europe; propagated by seeds; buried seeds remain viable for a number of years. Flowering period: spring to fall.—In cultivated fields, gardens, lawns, waste ground, and along roadsides; general and abundant in Ohio.

Control.—Prevent seed production by hand-pulling, grubbing, or deep hoe-cutting before bloom. This weed is easily controlled by cultivation.

59. **Sida spinosa** L. Prickly Sida.— Stiff, erect, branched stem; alternate, ovate or oblong lance-shaped leaves with scallop-toothed margins, borne on petioles that generally have a spine-like tubercle at the base; and small, short-stalked, axillary, yellow flowers. The 5 obovoid petals exceed the 5 triangular, pointed calyx-teeth. The fruit is composed of 5 hairy, 2-beaked carpels. The entire plant is more or less minutely hairy.

Annual introduced from the tropics; propagated by seeds. Buried seeds retain their vitality for some time. Flowering period: summer and early fall.—In corn and potato fields, gardens, pastures, and waste ground; thrives in dry soils; rather general distribution in Ohio, but more abundant in the southern counties.

Control.—Same methods as for roundleaf mallow.

60. ***Abutilon abutilon** (L.) Rusby. (*Abutilon theophrasti* Medic.) Velvet-leaf. Indian Mallow.— Tall, stout, erect, branched stem; alternate, long-petioled, broadly heart-shaped, long-pointed leaves with scallop-toothed or nearly entire margins; and showy, stout-stalked, yellow flowers borne singly in the axils of the leaves; the calyx is 5-cleft; the 5 petals are wedge-shaped. The conspicuous fruit is composed of 10-15 loosely united, long-beaked carpels. The entire plant is densely covered with velvety hairs.

Annual introduced from Asia; propagated by seeds, buried seeds retaining their vitality over a long period of years. Flowering period: summer and fall.—In cultivated fields (especially corn or potatoes on bottom land), barnyards, vacant lots, and waste places; most abundant in fertile soils; general and abundant in Ohio.

Control.—Prevent seed production. Hand-pulling, hoeing, or cutting before bloom is satisfactory for scattered plants; larger areas should receive clean cultivation, supplemented by hand methods. Plants bearing partly ripe fruits should be burned because the seeds will ripen after the plant has been cut. Waste-ground plants should be mowed; seeding down to meadow or pasture is an aid in the control both of this weed and bladder ketmia.

61. ***Hibiscus trionum** L. Bladder Ketmia. Flower-of-an-hour.— Erect or reclining stem, with basal branches; alternate, petioled leaves, ovate or circular in outline, but pedately divided into 3-7 blunt, wavy-toothed or cleft lobes, the middle one longer; and large, usually solitary, purple-eyed, pale yellow flowers in the axils of the upper leaves. The purple-veined, membranous, inflated, 5-angled calyx is much longer than the linear, subtending bracts; the 5 broad petals remain open only a few hours. The fruit is a hairy, globose-ovoid capsule; the entire plant is more or less bristly-hairy.

Annual introduced from Europe; propagated by seeds which remain viable for a number of years. Flowering period: summer and fall.—In cultivated fields (especially corn), gardens, roadsides, and waste ground; general distribution in Ohio.

Fig. 9

a. **Hibiscus trionum** (Bladder Ketmia)
b. **Chamaesyce maculata** (Spotted Spurge)
c. **Oxalis corniculata** (Procumbent Wood-sorrel) After Beal.
d. **Malva rotundifolia** (Roundleaf Mallow)
e. **Abutilon abutilon** (Velvet-leaf)

Control.—Prevent seed production by hand-pulling or cutting before bloom, or by clean, late-continued cultivation of a hoed crop, supplemented by hand methods; otherwise, the soil will be fouled by a late crop of seeds.

Note.—This plant was formerly cultivated as an ornamental.

HYPERICACEAE. St. John's-wort Family

62. **Hypericum perforatum** L. Common St. John's-wort.— Smooth, slender, erect, much-branched stem, frequently reddish below, arising from a woody base; opposite, sessile, small, oblong to linear, blunt, entire leaves, marked by numerous, punctate glands, as well as by black dots along the margins; and deep yellow flowers in showy, branched, terminal clusters. The 5 punctate, pointed, lance-shaped sepals are shorter than the 5 oblong, blunt petals with black-dotted margins. The fruit is an ovoid capsule with 3 cavities.

Perennial introduced from Europe; propagated by seeds and by runners from the woody base of the stem. Flowering period: summer and fall.—Often a troublesome weed in old pastures or meadows, waste places, and along roadsides; general distribution in Ohio.

Control.—Prevent seed production on small areas by hand-pulling when the ground is soft, or by digging out both the plants and runners before bloom. A handful of salt placed on the cut stems during hot weather will check new growth. Infested pastures and meadows should be mowed closely several times during the season or put under cultivation; grass crops should be avoided until the weed has been brought under control.

Note.—Growing plants are avoided by stock because of the acrid sap.

CARYOPHYLLACEAE. Pink Family

63. ***Alsine media** L. (*Stellaria media* (L.) Cyrill.) Common Chickweed.— Weak, tufted, profusely branched, ascending or creeping stems, smooth except for a longitudinal line of hairs; numerous, opposite, small, smooth, entire, ovate, pointed leaves, the lower ones narrowed to short, hairy-margined petioles; the upper leaves sessile; and small, slender-stalked, white flowers borne in leafy terminal clusters or singly in the axils. The 5 hairy, oblong, pointed sepals are longer than the 5 deeply 2-cleft petals. The fruit is a small, ovoid capsule longer than the calyx.

Annual and winter annual naturalized from Europe; propagated by seeds; buried seeds remain viable several years. Flowering and seeding period: throughout the year in sheltered places.—In gardens, cultivated fields, lawns (especially when shaded), meadows, strawberry beds, and waste places; most abundant in moist, fertile soils; grows profusely during the cooler spring and autumn months but it often dies down during the summer. In many instances the plants remain green during the winter months. General and abundant in Ohio.

Control.—Prevent seed production during early spring and late fall, as well as during the growing period of cultivated crops. Failure to apply control measures during the cooler months when this weed grows and seeds abundantly often accounts for failure to bring it under control. Clean cultivation, supplemented by hand methods and continued as late in the season as possible, is satisfactory for gardens and other tilled land. Early spring plowing and surface cultivation at intervals will induce germination and thus clear the soil of numerous buried seeds before the crop is planted; the final cultivation of the crop should be shallow to avoid bringing buried seeds near the surface of the soil. A dense growth of a winter smother crop such as rye is of some value.

Common chickweed is frequently a troublesome invader in lawns, especially if the turf is thin. Sodium chlorate, at a dilution of ⅔ ounce to a gallon of water, applied as a spray at monthly intervals during the winter months kills the weed but does not injure the lawn grasses.[2] Only sufficient solution is applied to wet the foliage. A single winter application of sodium chlorate at a dilution of 4 ounces to the gallon has proved about equally effective, but it generally causes some injury to the grasses. Bare or thin areas so caused should be reseeded the following spring. Winter or late-fall applications are advantageous, in that discoloration of the treated patches is less objectionable than it would be during spring or summer.

64. ***Cerastium vulgatum** L. Common Mouse-ear Chickweed.— Viscid-hairy, tufted, erect, ascending or prostrate stems; opposite, sessile, small, hairy, entire, oblong, pointed leaves; and small, white flowers borne in loose, terminal clusters on stalks that, at length, exceed the sepals in length. The 4 or 5 blunt, lance-shaped sepals equal or exceed the 5 2-cleft petals. The fruit is a small, cylindrical, often slightly curved capsule.

[2]According to F. A. Welton, Agronomist at The Ohio Agricultural Experiment Station.

Fig. 10

a. **Hypericum perforatum** (Common St. John's-wort) After Selby.
b. **Agrostemma githago** (Corn Cockle)
c. **Cerastium vulgatum** (Common Mouse-ear Chickweed)
d. **Alsine media** (Common Chickweed)

Perennial introduced from Europe; propagated by seeds. Flowering period: late spring to fall.—A weed of cultivated fields, gardens, lawns, dooryards, roadsides, and waste ground; general distribution in Ohio.

Control.—Prevent seed production by hoeing, hand-pulling, or clean cultivation before bloom.

This weed is also a persistent invader in many lawns. A few scattered plants may be destroyed without injury to the turf by spraying several times with the dilute solution of sodium chlorate previously recommended for common chickweed; a single winter application of sodium chlorate at a dilution of 8 ounces to the gallon is preferable for thick patches of this plant. This solution will cause injury to the grasses, and any bare areas should be reseeded the next spring.

65. **Cerastium viscosum** L. Mouse-ear Chickweed.— Viscid-hairy, tufted, ascending or spreading stems; opposite, sessile, small, hairy, ovate or obovate, blunt, entire leaves; and small, white flowers borne in fairly loose, terminal clusters on stalks that do not exceed the sepals in length. The pointed sepals equal or exceed the 2-cleft petals. The fruit is a small cylindrical capsule.

Annual introduced from Europe; propagated by seeds. Flowering period: spring and summer.—In cultivated fields, meadows, and waste ground.

Control.—Same methods as for common mouse-ear chickweed.

66. ***Agrostemma githago** L. Corn Cockle. Cockle.— Erect, slender stem, simple or with a few erect branches above; opposite, sessile, narrowly lance-shaped, pointed, entire leaves; and showy, reddish-purple flowers borne singly on long, stout, axillary stalks. The oblong, 10-ribbed calyx has 5 narrow, leaf-like teeth that greatly exceed the 5 slightly notched, wedge-shaped petals. The fruit is an ovoid capsule with one cavity. The entire plant is covered with whitish appressed hairs.

Annual and winter annual introduced from Europe; propagated by seeds. Flowering period: summer months.—Chiefly a weed of grainfields but grows in waste places and along roadsides; general distribution in Ohio.

Control.—Hand-pulling or spudding below the crown previous to bloom is satisfactory for scattered plants in grainfields and waste ground. Spring weeding supplemented by fall cultivation is recommended for badly infested grain crops, followed by a cultivated crop the next season. Fencerows and waste ground should be mowed before bloom. Plants with partly ripe seeds should be burned. In general, a short rotation that includes a cultivated crop will bring this weed under control.

Notes.—The seeds of corn cockle are removed with difficulty from wheat and the grower suffers dockage when they are present in considerable quantities. When the seeds are ground with wheat the flour has a dark color and unpalatable flavor, and bread made from it does not rise properly. The seeds contain a poisonous compound and flour, bran, or screenings that contain them are dangerous when any quantity is consumed. Young fowls are especially susceptible to the poisonous compound that occurs in the seeds. Buried seeds remain viable several years.

67. **Silene noctiflora** L. Night-blooming Catchfly.— Stout, erect, simple or branched stem; opposite, entire leaves, the basal and lower ones spatula-shaped, blunt, narrowed to margined petioles; the upper leaves sessile, broadly lance-shaped, pointed, often united around the stem; and large, stalked, white flowers in loose, few-flowered, terminal clusters. The 5-cleft, 10-ribbed, tubular calyx is inflated when mature; the 5 petals are 2-cleft. The fruit is an ovoid, narrowly toothed capsule. The entire plant is covered with viscid, glandular hairs.

Annual or winter annual introduced from Europe; propagated by seeds. Flowering period: summer and early fall.—A weed in meadows, grainfields, cultivated ground, and waste places; rather general distribution in Ohio.

Control.—Prevent seed production on small areas by hand-pulling, hoeing, or spudding below the crown before bloom. Badly infested meadows should be mowed early and put under clean cultivation the following season. Spring weeding and fall cultivation are satisfactory methods for grain crops.

Note.—The seeds are difficult to remove from clover.

68. **Silene antirrhina** L. Sleepy Catchfly.— Smooth or short-hairy, slender, erect stem, simple or branched above, with glutinous, swollen nodes; opposite smooth leaves, the basal ones spatula-shaped, narrowed to petioles; the stem leaves sessile, linear below but awl-

shaped beneath the inflorescence; and small, slender-stalked, pink flowers in loose terminal clusters. The 5-cleft, ribbed, ovoid calyx is inflated when mature; the 5 petals are notched. The fruit is an ovoid, broadly toothed capsule.

Native annual, propagated by seeds. Flowering period: summer and early fall.—In meadows, grainfields, and waste ground, especially on light sandy soils; general distribution in Ohio.

Control.—Same methods as for night-blooming catchfly.

69. **Saponaria officinalis** L. Bouncing-Bet. Soapwort.— Smooth, stout, erect, tufted, sparingly branched stems with swollen nodes; opposite, long-ovate or oval, thick, pointed, 3-ribbed leaves, sessile or on short, broad petioles; and showy pink flowers in dense terminal clusters with numerous, lance-shaped bracts. The 5-toothed, tubular calyx is faintly nerved; the 5 petals are broadly wedge-shaped. The fruit is an oblong, toothed capsule.

Perennial introduced from Europe; propagated by seeds and by rootstocks. Flowering period: summer and early fall.—Escaped from cultivation and is frequently a weed in yards, pastures, and waste places, as well as along roadsides and railways; general distribution in Ohio.

Control.—Prevent seed production and remove or starve out the perennial rootstocks. Grubbing to remove the rootstocks is recommended only for small patches. A heavy application of rock salt or strong salt brine will aid in killing the underground parts. Large areas should be subjected to repeated close cutting over a period of several seasons. Plowing and clean cultivation are satisfactory measures. Smothering with tar paper is satisfactory but too expensive, except for small areas.

Notes.—This plant was formerly cultivated, as the stems and rootstocks bruised in water made a foamy solution that served as a substitute for soap in cleaning silks and woolens.

PORTULACACEAE. Purslane Family

70. ***Portulaca oleracea** L. Purslane. Pursley. Pussley.— Smooth, fleshy, prostrate, mat-forming stems, freely branched from a central root; alternate, very short-petioled, small, smooth, fleshy, obovate or wedge-shaped leaves, clustered at the ends of the branches; and very small, solitary, sessile, terminal, yellow flowers. The 2 pointed, keeled sepals are united at the base; the 5 broad petals wither early. The membranous, urn-shaped, many-seeded capsule opens by a lid. This plant is frequently reddish in color.

Native annual from the Southwest; propagated by seeds; a large number of seeds are produced and remain viable in the soil over a long period of years. They germinate readily only when near the surface of warm soils. Flowering period: summer until killed by frost.—A weed of cultivated and waste ground; most troublesome in fertile gardens, muck land, and after a cultivated crop has been laid by.

Control.—Prevent seed production by destroying the young plants previous to bloom. Shallow hoeing and clean cultivation will suffice in gardens and cultivated fields; the final cultivation should be very shallow to prevent bringing a fresh supply of seeds to the surface. Plants with green fruits should be raked into piles or removed, because the plants take root readily or remain alive without soil attachment sufficiently long to ripen the seeds, due to the large amount of sap in the fleshy stems and leaves. Hoeing after cultivation ceases is often necessary to destroy late seedlings.

Purslane can be killed by a spray of iron sulphate.

Note.—Hogs relish this fleshy weed.

AIZOACEAE. Carpetweed Family

71. **Mollugo verticillata** L. Carpetweed.— Smooth, slender, prostrate, much branched, mat-forming stem; numerous, small, whorled, nearly sessile, spatula-shaped to linear, blunt, entire leaves; and very small, slender-stalked, axillary flowers. The 5 oblong sepals are whitish on the inside; the petals are wanting. The fruit is a small, ovoid, many-seeded capsule.

Native annual from the South; propagated by seeds. Flowering period: late spring to early fall.—In cultivated fields, gardens, yards, crevices of pavements, along roadsides, and in waste places; general distribution in Ohio.

Control.—Prevent seed production by hoe-cutting or hand-pulling before bloom. Clean cultivation will control it. Fall harrowing after the removal of the cultivated crop will destroy late seedlings.

PHYTOLACCACEAE. POKEWEED FAMILY

72. **Phytolacca americana** L. (*Phytolacca decandra* L.) Pokeweed. Poke.— Smooth, tall, stout, usually reddish, succulent, simple or branched stem with diaphragmed pith; alternate, petioled, large, smooth, entire, oblong lance-shaped leaves, pointed at both ends; and small, stalked, whitish flowers in long clusters, at first terminal but later becoming lateral by further growth of the stem. The calyx is composed of 4-5 oval sepals; the corolla is wanting. The juicy, purple, 10-seeded berries are borne in drooping clusters. This plant has an unpleasant odor when crushed.

Native perennial, propagated by seeds. Flowering period: summer months.—Chiefly a weed of waste ground; it is particularly troublesome in deep, moist, fertile soils; general and abundant in Ohio.

Control.—Grubbing, cutting below the crown, salting, or cultivating are effective control measures.

Note.—The roots are poisonous and the uncooked berries have been reported as slightly poisonous.

AMARANTHACEAE. AMARANTH FAMILY

73. ***Amaranthus retroflexus** L. Rough Pigweed. Green Amaranth.— Rough-hairy, stout, frequently tall, erect, simple or branched stem; alternate, slender-petioled, dull green, rough-hairy, bristle-tipped, ovate, rhombic-ovate or lance-shaped leaves with prominent veins, as well as wavy or entire margins; and small, greenish flowers in stout, compact, simple or branched, terminal or axillary clusters. The 3 awl-shaped bracts exceed the 5 dry, colorless sepals. The slightly wrinkled fruit is mostly shorter than the sepals.

Annual introduced from tropical America; propagated by seeds which are produced in large numbers and remain viable in the soil for a number of years. The succulent growth removes a large amount of water from the soil. Flowering period: summer and fall.—A common weed in cultivated fields, gardens, waste places, along roadsides, and around farm buildings; most troublesome in fertile soils; general and abundant in Ohio.

Control.—Prevent seed production by hand-pulling, hoe-cutting below the crown, or clean cultivation of a hoed crop, supplemented by hand methods after the crop has been laid by. The ground should be plowed early, followed by harrowing at intervals to induce germination and kill the maximum number of seedlings before the crop is planted. The tilled crop should be cultivated as late as possible and the final tillage should be shallow to avoid bringing a fresh supply of seeds to the surface. The seeds of rough pigweed germinate only when within an inch or so of the surface of a warm soil. Spring weeding is satisfactory for heavily infested grainfields. Waste ground should be mowed several times during the season. Partly ripe seeds will mature after the plant has been cut. Such plants should be collected and burned.

Young plants may be killed with a solution of either iron sulphate or copper sulphate in situations where other methods are not practicable.

74. ***Amaranthus hybridus** L. Slender Pigweed. Red Amaranth.— Similar in general appearance to the preceding species but usually smoother and more slender with smaller, darker green or purplish leaves and more slender-cylindric, flexuous clusters of flowers.

Annual introduced from tropical America; propagated by seeds which remain viable for a number of years. Flowering period: summer and fall.—A weed of cultivated fields, gardens, and waste ground; general distribution in Ohio.

Control.—Same methods as for rough pigweed.

75. **Amaranthus spinosus** L. Spiny Amaranth.— Nearly or quite smooth, green or reddish, stout, erect, ridged, bushy-branched stem; alternate, rhombic-ovate to lance-shaped, pointed, bristle-tipped leaves with a pair of stout, sharp spines at the base of the slender petioles; and small, light green flowers, the staminate ones in slender, flexuous, terminal clusters, the carpellate flowers below in short, head-like, axillary clusters. The broadly awl-shaped bracts about equal the 5 oblong, bristle-tipped sepals and the small, ovoid fruit.

Annual introduced from tropical America; propagated by seeds having long vitality. Flowering period: summer and early fall.—In cultivated fields, meadows, lawns, waste places, and along roadsides; frequent in the southern half of Ohio, especially in the southeastern river counties.

Control.—Prevent seed production by hand-pulling, hoe-cutting, close mowing, or clean, late-continued cultivation.

76. **Amaranthus graecizans** L. Tumble-weed (Amaranth).— Nearly or quite smooth, whitish, low, erect, bushy-branched stem; alternate, slender-petioled, small, smooth, pale

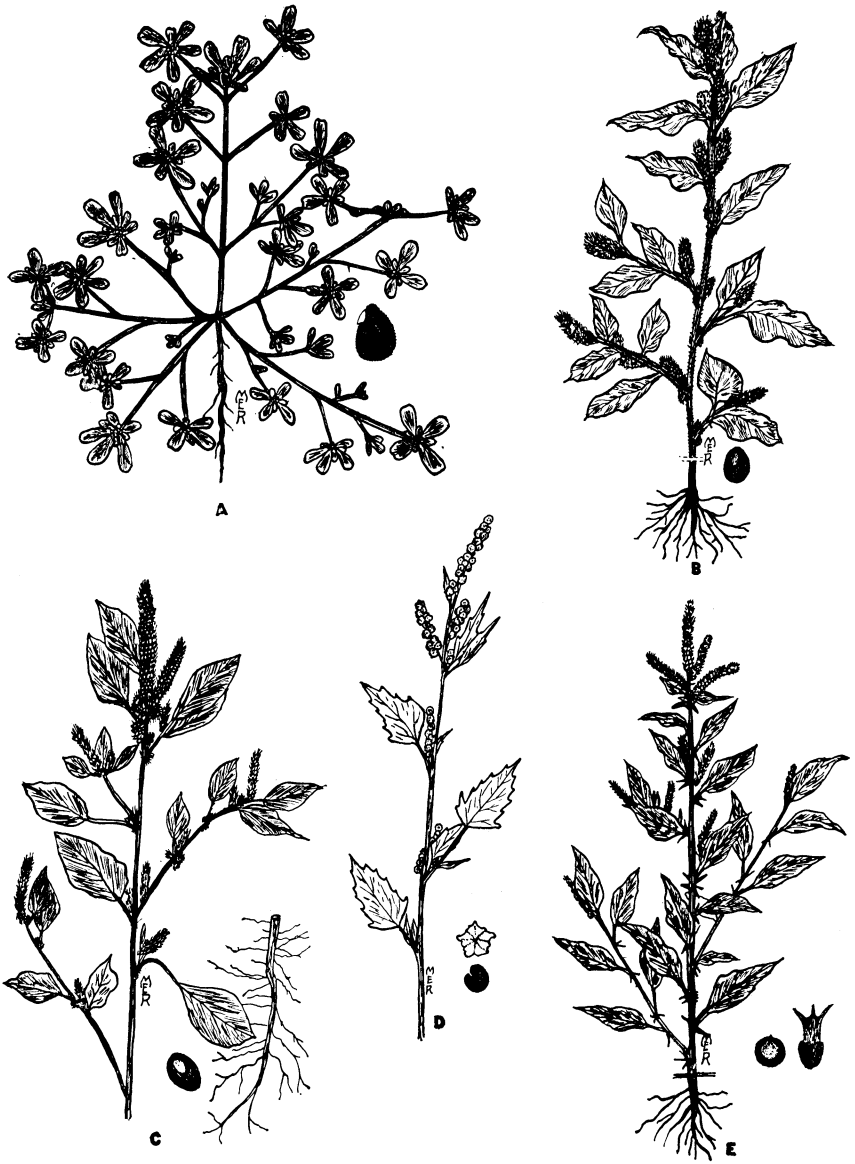

Fig. 11

a. **Mollugo verticillata** (Carpetweed)
b. **Amaranthus retroflexus** (Rough Pigweed)
c. **Amaranthus hybridus** (Slender Pigweed)
d. **Chenopodium album** (Lamb's-quarter)
e. **Amaranthus spinosus** (Spiny Amaranth)

green, oblong or spatula-shaped, bristle-tipped leaves; and small, greenish flowers, several together in axillary clusters. The spreading, awl-shaped bracts exceed the 3 membranous sepals. The wrinkled fruit exceeds the sepals.

Native annual, propagated by seeds. The plant breaks off and forms a tumbleweed toward the end of the season. Flowering period: summer and early fall.—A weed of waste ground, roadsides, railways, and sometimes in cultivated land; troublesome chiefly in the western half of Ohio.

Control.—Prevent seed production by hand methods or clean cultivation continued late in the season. Destroy all plants on waste land.

77. **Amaranthus blitoides** Wats. Mat Amaranth. Low Amaranth.— Nearly or quite smooth, somewhat ridged, pale green, prostrate, diffusely branched, mat-forming stem; alternate, smooth, obovate or spatula-shaped, bristle-tipped leaves, narrowed into slender petioles; and small, greenish flowers in axillary clusters. The oblong bracts are only slightly longer than the 3-5 oblong, lance-shaped sepals. The nearly smooth fruit about equals the sepals.

Native annual from the West; propagated by seeds. Flowering period: summer and fall.—In cultivated fields, gardens, yards, waste places, as well as along roadsides, railways, and walks; general distribution in Ohio.

Control.—Same methods as for tumble-weed (Amaranth) and rough pigweed.

78. **Acnida tamariscina** (Nutt.) Wood. Western Pigweed.—Nearly or quite smooth, tall, erect, much-branched stem, frequently striped with red; alternate, lance-shaped or ovate lance-shaped, mostly long-pointed but sometimes blunt, bristle-tipped leaves narrowed to slender petioles; and small, 1-3-bracted, greenish flowers in dense or interrupted, narrowly cylindrical, terminal and axillary spikes. The calyx of the staminate flower has 5 pointed sepals; the carpellate flower is without a calyx. The ovoid, membranous fruit opens by a lid.

Native annual from the West; propagated by seeds. Flowering period: summer and early fall.—In wet fields and along marshes or streams.

Control.—Drainage. Prevent seed production by close cutting or hand-pulling before bloom or by clean cultivation.

CHENOPODIACEAE. Goosefoot Family

79. ***Chenopodium album** L. Lamb's-quarter. White Goosefoot.— Smooth, grooved, stout, erect, sometimes tall, frequently branched stem; alternate, slender-petioled, toothed, wavy-lobed or entire leaves, varying in shape from rhombic-ovate below to lance-shaped or linear toward the top, the upper surface smooth, the lower white-mealy; and small, sessile, greenish flowers in simple or branched, terminal clusters as well as spike-like, axillary ones. The calyx is composed of 5 fleshy, ridged lobes that enclose the fruit; the corolla is wanting. The circular, flattened fruit contains a single, somewhat lens-shaped, black seed.

Annual introduced from Europe; propagated by seeds which are produced in large numbers and remain viable in the soil for several years, as well as after passage through the alimentary tracts of animals. Flowering period: summer and fall.—In cultivated fields (especially corn and potatoes), gardens, roadsides, and waste places; most frequent in fertile soils; general and abundant in Ohio.

Control.—Prevent seed production by hand-pulling or deep hoeing before bloom or by clean, late-continued cultivation supplemented by hoeing after the crop has been laid by. Badly infested fields should receive repeated surface cultivation after the crop has been removed to destroy fall seedlings. Spring weeding is advisable for heavily infested grain-fields. Sheep are a valuable aid in destroying fall seedlings.

Note.—This weed absorbs large amounts of water and mineral salts from the soil.

80. **Chenopodium glaucum** L. Oakleaf Goosefoot.— Smooth, somewhat succulent, grooved, partly erect stem with spreading or prostrate branches; alternate, oblong to lance-shaped, mostly wavy-toothed or lobed leaves, smooth above but white-mealy beneath, the lower ones petioled, the upper sessile or nearly so; and greenish flowers in small, often branched, spike-like, axillary clusters. The calyx is composed of 5 blunt, oblong, unridged lobes that do not entirely enclose the fruit. The circular, flattened fruit contains a single brown seed.

Annual introduced from Europe; propagated by seeds. Flowering period: summer and fall.—In both cultivated and waste ground, as well as often along railways; this weed has been reported from several counties of Ohio.

Control.—Same methods as for lamb's-quarter.

81. **Chenopodium murale** L. Nettle-leaf Goosefoot.— Smooth, erect or decumbent, generally branched stem, leafy to the top; alternate, slender-petioled, thin, bright green,

mostly smooth, rhombic-ovate, coarsely but sharply wavy-toothed, pointed leaves; and greenish flowers in loose, branched, axillary clusters. The calyx is composed of 5 unridged lobes that do not entirely enclose the much flattened fruit.

Annual introduced from Europe; propagated by seeds. Flowering period: summer and fall.—In cultivated ground and waste places; rather general distribution in Ohio.

Control.—Same methods as for lamb's-quarter.

82. ***Chenopodium hybridum** L. Maple-leaf Goosefoot.— Smooth, grooved, slender, erect stem with spreading branches; alternate, slender-petioled, thin leaves, the ovate, long-pointed, lower ones with 1-4 large teeth along each side; the upper leaves lance-shaped, mostly entire; and greenish flowers in large, leafless, axillary and terminal clusters. The calyx is composed of 5 oblong, rather blunt, slightly ridged lobes that do not entirely enclose the fruit.

Native annual, propagated by seeds. Flowering period: summer and fall.—Mostly a weed of waste ground, especially in shaded places; rather general distribution in Ohio.

Control.—Same methods as for lamb's-quarter.

83. **Chenopodium botrys** L. Feather-geranium.— Slender, erect, simple or branched stem; alternate, short-petioled to sessile, oblong leaves, irregularly pinnately divided into blunt, scarcely toothed lobes; and small, greenish flowers in numerous, spreading, axillary clusters. The calyx is composed of 3-5 thin, lance-shaped, pointed lobes that generally exceed the fruit. This plant is both glandular-hairy and strong-scented.

Annual introduced from Europe; propagated by seeds. Flowering period: summer and fall.—Mostly a weed of waste ground; rather general distribution in Ohio.

Control.—Same methods as for lamb's-quarter.

Note.—This plant is avoided by grazing animals.

84. **Chenopodium ambrosioides** L. (Incl. *C. anthelminticum* L.) Mexican-tea.— Grooved, leafy, erect stem with numerous, ascending branches; alternate, oblong or lance-shaped leaves, the lower ones wavy-toothed, tapered to short petioles; the upper leaves much smaller, slightly toothed or entire, sessile or nearly so; and small, greenish flowers in leafy, compact, spike-like, axillary clusters. The calyx is composed of 3-5 lobes that enclose the fruit. This plant is smooth or slightly glandular-hairy, as well as strong-scented.

Annual introduced from tropical America; propagated by seeds. Flowering period: summer and fall.—In permanent pastures, farmyards, along roadsides, and in waste places; rather general distribution in Ohio but more frequent in the southern counties.

Control.—Same methods as for lamb's-quarter.

Note.—This plant is avoided by grazing animals.

85. **Atriplex hastata** L. (*Atriplex patula hastata* (L.) Gr.) Halberd-leaf Orache.— Grooved, spreading, ascending or erect, diffusely branched stem; mostly alternate, slender-petioled, pointed, entire or slightly toothed leaves, the lower ones triangular arrow-shaped with spreading, pointed, basal lobes; the upper leaves linear lance-shaped; and greenish flowers in slender, interrupted, terminal spikes as well as small, head-like, axillary clusters. The bractless, staminate flower consists of 3-5 united sepals and an equal number of stamens; the carpellate flower is subtended by 2 roughly triangular bracts that become fleshy, slightly toothed and tubercled in fruit. This plant is frequently covered with small, white, scurfy scales.

Native annual, propagated by seeds. Flowering period: midsummer to the end of the season.—In cultivated land, vacant lots, along railways, and in other waste ground; general distribution in Ohio.

Control.—Prevent seed production by hand-pulling or cutting below the crown before bloom or by clean cultivation. This weed stools freely when cut above the ground.

86. **Salsola pestifer** Nels. Russian-thistle.— Woody, slightly ridged, bushy-branched stem frequently streaked with red; alternate, sessile, small, grayish, linear or awl-shaped, spiny-tipped leaves; and inconspicuous, sessile, axillary, white or pinkish flowers. The calyx consists of 5 membranous sepals that become horizontally winged in fruit, enclosing the flattened top-shaped fruit. The plant varies from smooth to somewhat hairy. The young plants have slender, succulent stem and leaves. The seedlings easily escape notice due to their grass-like appearance.

Annual introduced from Europe and western Asia; propagated by seeds; each plant produces a very large number of seeds that remain viable in dry soils for several years. The dry plant is a tumbleweed that scatters seeds throughout the winter. Flowering period: summer and fall.—Russian-thistle is a weed of cultivated and waste ground but flourishes

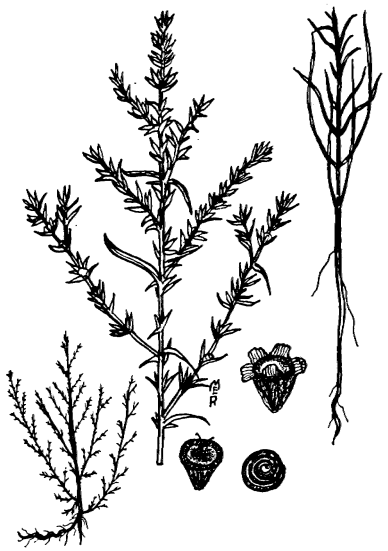

Fig. 12
Salsola pestifer (Russian-thistle)

only in dry soils; it is a noxious weed in the northwestern states where first introduced. Probably introduced into Ohio in western stock cars or agricultural seeds as it has appeared at local points in the northern counties, especially along trunk railways.

Control.—Prevent seed production by hand-pulling, deep hoeing, or close mowing before bloom or preferably in the seedling stage when the weed is most easily eradicated. It is controlled by clean, late-continued cultivation of tilled crops. This weed is brought under control by seeding to legumes or grasses because it seldom becomes established in sod. Plants with partly ripe seeds should be burned. Avoid spring grains in the rotation until it is brought under control.

PRIMULACEAE. PRIMROSE FAMILY

87. **Lysimachia nummularia** L. Moneywort. Creeping Loosestrife.— Smooth, slender, creeping stem, often rooted at the nodes; numerous, opposite, short-petioled, circular or broadly oval, smooth, entire, glandular-punctate leaves, often heart-shaped at the base; and stalked, black-dotted, yellow flowers, solitary in the axils of the leaves. The 5-7 ovate to lance-shaped sepals are less than half as long as the 5-lobed, wheel-shaped corolla. The ovoid to globose fruit is shorter than the ovate to lance-shaped sepals.

Perennial naturalized from Europe; propagated by seeds. Flowering period: summer months.—This plant is an escape from cultivation in gardens and cemeteries; often a weed in lawns, and along roadsides; most abundant in moist soils; general distribution in Ohio.

Control.—Hoeing or hand-pulling before bloom is satisfactory for small areas. Frequent close mowing to prevent seed production and to starve out the roots is advisable for large areas. This weed is destroyed by clean cultivation. Small isolated patches may be killed by salting or smothering with tar paper.

Note.—The prostrate stems form dense patches that crowd out the grass in thin lawns.

POLYGONACEAE. BUCKWHEAT FAMILY

88. ***Rumex crispus** L. Curled Dock. Yellow Dock.— Smooth, several-grooved, rather slender, often tall, erect stem, simple or branched toward the top; cylindric, sheathing, membranous stipules; alternate, narrowly oblong to lance-shaped, smooth leaves with wavy, crumpled margins, the lower ones long- and stout-petioled; the upper leaves short-petioled, much smaller; and small, stalked, greenish flowers in long, cylindrical, erect, mostly compound clusters. The ovoid, 3-angled, dark brown, shining fruit is enclosed in the 3 inner, heart-shaped, tubercled, nearly or quite entire sepals.

A root perennial naturalized from Europe; propagated by seeds and frequently by shoots from the crown. The winged fruits are rather easily disseminated by wind or water. Flowering period: summer months.—In meadows, pastures, waste ground, around farm buildings, and along roadsides; it is especially frequent in moist soils; general and abundant in Ohio.

Control.—Spudding or deep hoe-cutting below the crown is satisfactory for scattered plants. Salting will help to prevent sprouting. Hand-pulling when the soil is moist is satisfactory for young plants. Large areas in meadows, pastures, and waste ground should be mowed before bloom. Badly infested fields should be put under clean cultivation. Plants with partly ripe seeds should be collected and burned.

89. ***Rumex obtusifolius** L. Broadleaf Dock. Blunt-leaved Dock.— Smooth or somewhat scurfy, grooved, stout, erect, often tall, simple or sparingly branched stem; alternate, oblong lance-shaped, smooth, slightly wavy-margined leaves, the lower ones large, long-

Fig. 13

a. **Atriplex hastata** (Halberd-leaf Orache)
b. **Chenopodium hybridum** (Maple-leaf Goosefoot)
c. **Rumex crispus** (Curled Dock)
d. **Rumex obtusifolius** (Broadleaf Dock)

petioled, heart-shaped or rounded at the base; the upper leaves narrower, short-petioled; and small, stalked, greenish flowers in long, loose, compound clusters. The ovoid, 3-angled, dark red, shining fruit is enclosed in the 3 veined, few-toothed, ovate or arrow-shaped sepals, one of which has a tubercle on the back.

A root perennial naturalized from Europe; propagated by seeds and frequently by shoots from the crown. Flowering period: summer months.—In fields, meadows, pastures, barnyards, waste places, and along roadsides; general and abundant in Ohio.

Control.—Same methods as for curled dock.

90. ***Rumex acetosella** L. Sheep Sorrel. Sorrel. Sour-dock.— Smooth, slender, low, erect, simple or branched stem; silvery, 2-lobed, sheathing stipules; alternate, petioled, light green leaves, the lower ones narrowly arrow-shaped with spreading, basal lobes; the uppermost leaves often linear as well as without lobes; and small, stalked flowers in slender, interrupted, compound, terminal clusters. The staminate flowers are yellowish-green; the carpellate flowers are reddish-green. The small, 3-angled, granular, brown fruit exceeds the persistent calyx. This plant contains an acid sap.

Perennial naturalized from Europe; propagated by seeds and by tough, creeping, yellowish roots, as well as to some extent by underground stems. Flowering period: late spring to early fall.—Chiefly a weed of meadows and pastures; found also along roadsides and in waste ground. It thrives in soils that are too acid for a good growth of a number of crops and grows well in alkaline soils when not in competition with other plants; general and abundant in Ohio.

Control.—Sheep sorrel is unable to compete successfully with a thick, vigorous stand of legumes or grasses. The common legumes in particular and crop plants in general make their best growth in fertile, neutral, or somewhat alkaline soils and fail to do so in acid soils that, on the other hand, allow a heavy growth of this weed. Proper liming to correct the acidity of acid soils is a valuable part of the control program when coupled with drainage and fertilization.

Sheep sorrel succumbs rather readily to clean cultivation of a crop such as corn; cultivation drags the creeping roots to the surface.

Infested pastures, roadsides, and waste ground should be mowed a couple of times during the season previous to bloom.

Surface cultivation after harvest to drag out the roots is sometimes advisable for badly infested grainfields.

Spraying with a solution of iron sulphate has been found effective when the application is made before bloom. It is too costly for field operations but occasionally is practicable for destroying small patches that are difficult to attack by other methods.

91. * **Tiniaria convolvulus** (L.) Webb and Moq. (*Polygonum convolvulus* L.). Black Bindweed.— Smooth or somewhat scurfy, slender, twining or trailing, branched stem; oblique sheathing stipules, open on the side facing the leaf; alternate, slender-petioled, arrow-shaped, pointed, hairy-margined leaves, heart-shaped at the base; and small greenish-white flowers in long or short, slender, interrupted, axillary clusters. The small, obovoid, 3-angled, dull, granular, black fruit is enclosed in the persistent, 5-lobed calyx.

Annual naturalized from Europe; propagated by seeds which do not germinate until the soil is warm. Flowering period: summer and early fall.—In cultivated ground, grainfields, waste places, and especially abundant in bottom lands where seeds may be disseminated during the overflow of streams; general distribution in Ohio.

Control.—Prevent seed production throughout the season by destroying seedlings before they begin to twine around crop plants. Spring weeding, supplemented by repeated surface cultivation after harvest, is advisable for infested grain crops.

Note.—The twining habit of this plant makes it a bad weed in grainfields.

92. **Persicaria lapathifolia** (L.) S. F. Gr. Pale Persicaria.— Smooth, more or less erect, simple or much branched stem, somewhat swollen at the nodes; cylindric, finely ribbed, sheathing stipules without fringing hairs; alternate, short-petioled, oblong lance-shaped, long-pointed, hairy-margined, faintly punctate leaves; and small, white or pinkish flowers in long, slender, rather dense, drooping, spike-like, sometimes glandular clusters. The ovoid or oblong, lens-shaped, short-pointed, lustrous, dark brown fruit is somewhat net-veined.

Annual naturalized from Europe; propagated by seeds. Flowering period: summer and early fall.—In fields, meadows, and waste places; most abundant in moist soils; general distribution in Ohio.

Control.—Same methods as for Pennsylvania persicaria.

Fig. 14

a. **Rumex acetosella** (Sheep Sorrel)
b. **Tiniaria convolvulus** (Black Bindweed)
c. **Persicaria pennsylvanica** (Pennsylvania Persicaria)
d. **Persicaria persicaria** (Lady's-thumb)

93. *Persicaria pennsylvanica (L.) Small. (*Polygonum pennsylvanicum* L.) Pennsylvania Persicaria. Pennsylvania Knotweed.— Erect or sprawling, simple or branched, often tall stem, somewhat woody when old, smooth below but glandular-hairy above, as well as on the upper leaves and flower-stalks; thin, cylindric sheathing stipules without fringing hairs; alternate, short-petioled, lance-shaped, long-pointed leaves, hairy along the margins; and dark pink flowers in dense, stout, oblong, erect, spike-like clusters. The nearly circular, lens-shaped, short-pointed, brown or black fruit is smooth and lustrous.

Native annual, propagated by seeds. Flowering period: summer and fall.—In pastures, meadows, cornfields, along ditches, and in waste ground; troublesome chiefly in moist soils; general and abundant in Ohio.

Control.—Improved drainage. Prevent seeding by hand methods, mowing, and clean cultivation.

94. *Persicaria persicaria (L.) Small. (*Polygonum persicaria* L.) Lady's-thumb. Common Persicary.— Smooth or short-hairy, erect or spreading, simple or branched stem; nearly smooth, cylindric sheathing stipules, inconspicuously fringed with bristles; alternate, short-petioled or almost sessile, lance-shaped to linear lance-shaped, punctate leaves, pointed at both ends, often with hairy margins, as well as a dark blotch in the middle of the blade; and small, pink or purplish flowers in dense, ovoid or oblong, spike-like clusters. The ovate, lens-shaped, black fruit is smooth and lustrous.

Annual naturalized from Europe; propagated by seeds. Flowering period: summer and fall.—In fields and waste places; most abundant in moist soils where it frequently chokes out crops; general and abundant in Ohio.

Control.—Same methods as for Pennsylvania persicaria.

95. *Persicaria hydropiperoides (Mx.) Small. (*Polygonum hydropiperoides* Mx.). Mild Smartweed. Mild Water-pepper.— Smooth or appressed-hairy, slender, simple or branched stem, varying in habit from erect to prostrate; loose, cylindric, appressed-hairy, sheathing stipules fringed with slender bristles; alternate, short-petioled, lance-shaped, pointed leaves with hairy margins as well as appressed hairs on the midribs beneath; and small, white or pink flowers in long, slender, loose, erect, spike-like clusters. The ovoid to oblong, 3-angled fruit is smooth and lustrous.

Native root perennial, propagated by seeds. Flowering period: summer and fall.—A weed in wet meadows, pastures, and waste ground; general distribution in Ohio.

Control.—Improved drainage. Small areas should be removed by grubbing; badly infested meadows and pastures should be mowed at frequent intervals throughout the season to prevent seed production and to starve out the perennial underground parts. A clean cultivated crop is advisable where drainage conditions permit.

96. *Persicaria hydropiper (L.) Opiz. (*Polygonum hydropiper* L.) Water Smartweed. Smartweed. Water-pepper. Common Smartweed.— Smooth, often reddish, slender, erect, simple or branched stem; cylindric, sheathing stipules fringed with short bristles, as well as generally swollen at the base; alternate, short-petioled, lance-shaped, pointed, glandular-punctate leaves with hairy, entire or wavy margins; and small, greenish flowers in long, slender, loose, drooping, spike-like clusters. The broadly oblong to ovoid, 3-angled or lens-shaped, reddish-brown fruit is dull and granular. This plant has an acrid sap that is very irritating to the skin.

Annual introduced from Europe; propagated by seeds. Flowering period: summer and fall.—In low meadows, pastures, and waste places; abundant only in moist soils; general distribution in Ohio.

Control.—Improved drainage. Prevent seed production by mowing or by clean cultivation continued as late in the season as possible.

97. **Polygonum aviculare** L. Doorweed. Knotweed. Goosegrass.— Smooth, pale green, finely grooved, slender, prostrate or partially erect stem with numerous basal branches; papery, 2-lobed or irregularly cleft sheathing stipules; alternate, short-petioled or sessile, small, bluish-green, oval or oblong, usually pointed leaves, jointed at the base; and small, stalked flowers, 1-5 together in axillary clusters. The 5 greenish sepals have white, pink, or purplish margins. The ovoid, 3-angled, pointed, brown fruit is slightly ridged.

Native annual, propagated by seeds. Flowering period: summer and fall.—A weed in gardens, dooryards, lawns, waste ground, along walks and roadsides, sometimes in cultivated fields; flourishes in dry trodden ground; general and abundant in Ohio.

Control.—Prevent seed production by hoeing or clean cultivation of a hoed crop. Frequent raking to raise the plants, followed by close mowing, is helpful for preventing seed production in lawns. Salting is satisfactory for scattered plants in driveways and along walks.

Fig. 15

a. **Medicago lupulina** (Hop Medic)
b. **Persicaria hydropiperoides** (Mild Smartweed)
c. **Persicaria hydropiper** (Water Smartweed)
d. **Oenothera biennis** (Common Evening-primrose)

98. **Polygonum erectum** L. Erect Knotweed.— Smooth, yellowish-green, finely grooved, erect or ascending, much branched stem; papery, irregularly cleft, sheathing stipules; alternate, sessile or short-petioled, oval, oblong or obovate, often blunt, pale green leaves, jointed at the base; and small, stalked flowers, 1-2 together in axillary clusters. The 5 greenish-yellow, persistent sepals nearly enclose the ovoid, 3-angled, pointed, slightly ridged, brown fruit.

Native annual, propagated by seeds. Flowering period: summer and fall.—A weed in the same situations as doorweed, but neither as general nor abundant.

Control.—Same methods as for doorweed.

ROSACEAE. Rose Family

99. ***Potentilla monspeliensis** L. Rough Cinquefoil. Tall Five-finger.— Rough-hairy, stout, erect stem, branched toward the top, often woody and reddish in color when mature; alternate, 3-foliate leaves, the lower ones petioled, the upper sessile; obovate, blunt, deeply and coarsely toothed, hairy leaflets; lance-shaped, usually toothed, leaf-like stipules; and stalked, pale yellow flowers in rather compact terminal clusters. The 5 obovate petals are shorter than the hairy, ovate sepals. The small, roughly ovoid or kidney-shaped fruit is marked with curved longitudinal ridges.

Fig. 16
Potentilla monspeliensis (Rough Cinquefoil)

Native annual, biennial, or perennial, propagated by seeds. Flowering period: summer and early fall.—A weed in meadows, old pastures, waste places, and sometimes in cultivated ground; flourishes in sandy or dry, sterile soils; general distribution in Ohio.

Control.—Repeated cutting below the crown previous to bloom is satisfactory for scattered plants in meadows, pastures, and waste ground; repeated mowing is necessary for large areas because this plant sends up new shoots from the crown. Badly infested fields should be planted to a hoed crop.

100. **Potentilla canadensis** L. Common Five-finger. Cinquefoil.— Loosely hairy, slender, tufted, decumbent stems with creeping runners; alternate, slender-petioled, 3-5-foliate leaves; obovate or oblong, blunt, toothed leaflets, loosely hairy beneath; lance-shaped, pointed, entire or slightly toothed stipules; and golden-yellow flowers on slender, hairy stalks, solitary in the axils. The 5 petals are longer than the pointed sepals. The small, ovoid fruit is marked with wavy, broken ridges.

Native perennial, propagated by seeds and by slender wiry runners. Flowering period: spring and summer.—A weed in old meadows, pastures, and waste places; it flourishes in dry sterile soils; general and abundant in Ohio.

Control.—Digging or hoe-cutting below the crown previous to bloom is satisfactory for scattered plants. A rotation that includes legumes and a cultivated crop, in conjunction with liming and fertilization, is advisable for badly infested fields since this weed is rather effectively crowded out by a vigorous growth of forage plants.

101. **Rubus alleghaniensis** Port. (*Rubus nigrobaccus* Baily.) High Blackberry. High-bush Blackberry.— Red or purplish, woody, tall, erect or arched ascending stems covered with hooked prickles; alternate, stout-petioled, pinnately compound leaves composed of 3-5 ovate or ovate lance-shaped, pointed, closely toothed leaflets, lighter green and some-

what hairy beneath, the stalked terminal one larger than the short-stalked or sessile lateral ones; and numerous white flowers in elongated, terminal or axillary, leafless clusters. The flower has 5 lance-shaped sepals and 5 obovate petals. The oblong or thimble-shaped fruit is composed of numerous, small, black, edible drupelets.

Native perennial, propagated by seeds. In pastures, meadows, open woods, and along fencerows and roadsides, as well as in waste places, but seldom in cultivated ground; mostly in dry soils; general and abundant in Ohio.

Control.—Grubbing is satisfactory for scattered plants. Repeated close cutting throughout the season to starve out the underground parts and prevent seed production or close cutting during late summer, supplemented by an application of salt or kerosene to prevent sprouting, is satisfactory for larger areas. Plowing during late summer or fall, followed by a cultivated crop the next season, is suitable for heavily infested tillable land. Sheep will help to keep down new growth in the spring.

102. **Rosa virginiana** Mill. (*Rosa humilis* Marsh). Virginia Rose. Wild Rose. Pasture Rose.— Woody, fairly tall, bushy-branched stems armed with straight, slender prickles; alternate, petioled, pinnately compound leaves composed of 5-7 oval or obovate, coarsely-toothed leaflets, dull or slightly glossy above, pale as well as sometimes hairy beneath; and showy pink flowers, solitary or several together on hairy stalks. The calyx has 5 lance-shaped lobes; the corolla has 5 broadly wedge-shaped petals. The glandular-hairy, globose or slightly flattened fruit is orange-red in color.

Native perennial, propagated by seeds and by sprouts from the underground parts. Flowering period: late spring and summer.—In low pastures and waste ground; general and abundant in Ohio.

Control.—Grubbing is satisfactory for a few scattered bushes. Larger areas can be handled by cutting, supplemented by an application of salt, kerosene, or one of the chlorates at a later date to kill the crop of sprouts.

103. **Rosa rubiginosa** L. Sweetbrier (Rose).— Woody, tall, slender, branched stems armed with stout, mostly hooked prickles; alternate, petioled, pinnately compound leaves composed of 5-7 broadly oval, finely double-toothed, aromatic leaflets, densely glandular-hairy as well as resinous beneath; and showy pink flowers on hairy stalks. The smooth, ovoid fruit is orange-red in color.

Perennial introduced from Europe; propagated by seeds and by sprouts from the underground parts. Flowering period: summer months.—General distribution in Ohio.

Control.—Same methods as for Virginia rose.

104. **Agrimonia parviflora** Sol. Small-flowered Agrimony. Stickseed.— Stout, erect, branched stem densely covered with brownish hairs; alternate, pinnately compound leaves with deeply cleft, clasping, leaf-like stipules at the base of the hairy petioles; 9-17 lance-shaped to linear lance-shaped, sharply toothed, pointed leaflets interposed with several pairs of smaller, ovate segments, all glandular and hairy beneath; and small, light yellow flowers in narrow, elongated, terminal and axillary clusters. The fruit is a small, top-shaped bur with rows of hooked, radiating bristles below the top.

Native perennial, propagated by seeds; the fruits are readily disseminated on clothing and the coats of animals, especially sheep. Flowering period: summer and fall.—In low meadows, pastures, and along streams; prevalent in sandy and alluvial soils; general distribution in Ohio.

Control.—Good drainage. Hand-pulling when the ground is soft is satisfactory for scattered plants or small patches. Frequent close mowing throughout one or more seasons to starve out the roots and prevent seed production or clean cultivation of a hoed crop are suitable methods for large areas.

105. **Agrimonia gryposepala** Wallr. (*Agrimonia hirsuta* (Muhl.) Bickn.) Hairy Agrimony. Stickseed.— Erect, rather slender stem covered with fine, spreading hairs; alternate, pinnately compound leaves with broad, coarsely toothed stipules at the base of the hairy petioles; mostly 7 large, bright green, elliptic to broadly oblong, coarsely toothed, pointed leaflets interposed with several pairs of smaller ovate segments, all glandular, as well as sometimes lightly hairy, along the veins and margins beneath; and small, yellow flowers in narrow, elongated clusters. The fruit is a small, top-shaped bur with rows of hooked, radiating bristles below the top.

Native perennial, propagated by seeds. Flowering period: mostly during the summer months.—In open woodland pastures, thickets, ravines, and along streams; general distribution in Ohio.

Control.—Same methods as for small-flowered agrimony.

Note.—The fruits are particularly troublesome in wool.

106. **Crataegus** sp. Hawthorn. Thorn. Haw.— Small trees or shrubs with alternate, petioled, toothed, cleft or lobed leaves with stipules or stipular scars, usually with axillary thorns; and white or rarely pink flowers in terminal clusters. The cup- or bell-shaped calyx has 5 lobes; the corolla has 5 spreading, rounded petals. The fruit is a small, approximately globose, yellow to red pome that contains 1-5 bony nutlets.

Native shrubs or small trees, except one species, introduced from Europe and sometimes escaped from cultivation; propagated by seeds.—In permanent pastures, thickets, and open woods.

Control.—Grubbing is a laborious but effective method, applicable only for a small number of bushes. Cutting is fairly satisfactory when supplemented by an application of salt around the crown to prevent sprouting.

FABACEAE. Bean Family. Legumes

107. **Melilotus alba** Desv. White Sweet-clover. White Melilot.— Slender, somewhat woody, erect or ascending, branched stem; alternate, pinnately trifoliate leaves with awl-shaped stipules at the base of the petioles; 3 oblong-ovate to inversely lance-shaped, finely but sharply toothed leaflets, narrowed at the base, blunt or frequently notched at the tip; and white flowers in long, slender, 1-sided, axillary clusters. The fruit is an ovoid, dark green, slightly ribbed, pointed, 1-2-seeded pod.

Biennial introduced from Europe; propagated by seeds, which are sometimes an adulterant in red clover or alfalfa seed. Flowering period: summer and fall.—Although a valuable plant under cultivation, it is frequently an unsightly weed of roadsides, vacant lots, and waste ground; general and abundant in Ohio.

Control.—Hand-pulling when the ground is soft or spudding below the crown is effective for control. Roadsides and waste ground should be mowed closely several times during a season. Clean cultivation is satisfactory.

108. **Melilotus officinalis** (L.) Lam. Yellow Sweet-clover. Yellow Melilot.— Similar in general appearance to the preceding species, but the leaflets are more rounded at the tip and some of them may be oval in shape; the flowers are yellow; the fruit is a wrinkled, cross-ribbed, sometimes slightly hairy pod.

Biennial introduced from Europe; propagated by seeds. Flowering period: summer and fall.—This forage plant is frequently a weed of roadsides, vacant lots, and waste ground. Rather general distribution in Ohio but less abundant than white sweet-clover.

Control.—Same methods as for white sweet-clover.

109. ***Medicago lupulina** L. Hop Medic. Black Medick. Yellow Trefoil.— Finely hairy, slender, decumbent or partly erect stem with numerous, spreading branches from the base; small, alternate, pinnately trifoliate leaves with ovate or lance-shaped stipules at the base of the petioles; 3 small, slightly hairy, obovate or nearly circular leaflets, slightly toothed at the tip, narrowed or rounded at the base; and small, bright yellow flowers in dense, oblong, long-stalked heads. The fruit is a curved, kidney-shaped, slightly hairy, 1-seeded pod that becomes black when ripe.

Annual introduced from Europe; propagated by seeds which are sometimes an adulterant in alfalfa seed. Flowering period: spring to the end of the season.—Chiefly in meadows and waste ground, but sometimes in lawns; general distribution in Ohio.

Control.—Hand-pulling, hoeing, or close mowing before bloom. The weed is controlled by cultivation and to some extent may be crowded out by a vigorous stand of legumes.

Note.—Grazing animals relish this plant but it does not approach the larger cultivated legumes in forage value, especially as hay.

110. **Vicia cracca** L. Cow Vetch. Perennial Vetch.— Weak, slender, angled, branched, often mat-forming stem, trailing or climbing by tendrils at the end of the leaves; alternate, pinnately compound leaves with small, linear, pointed stipules at the base of the short petioles; 18-24 linear to linear-oblong, bristle-tipped leaflets; and numerous, bluish-purple flowers in dense, 1-sided, axillary clusters that about equal the leaves in length. The fruit is an oblong, smooth, short-stalked, 5-8-seeded pod. This plant is smooth or finely appressed-hairy.

Native perennial, propagated by seeds and by creeping rootstocks. Flowering period: summer months.—In old meadows, borders of thickets, waste ground, and sometimes in grainfields where its twining habit is troublesome; reported from a number of Ohio counties.

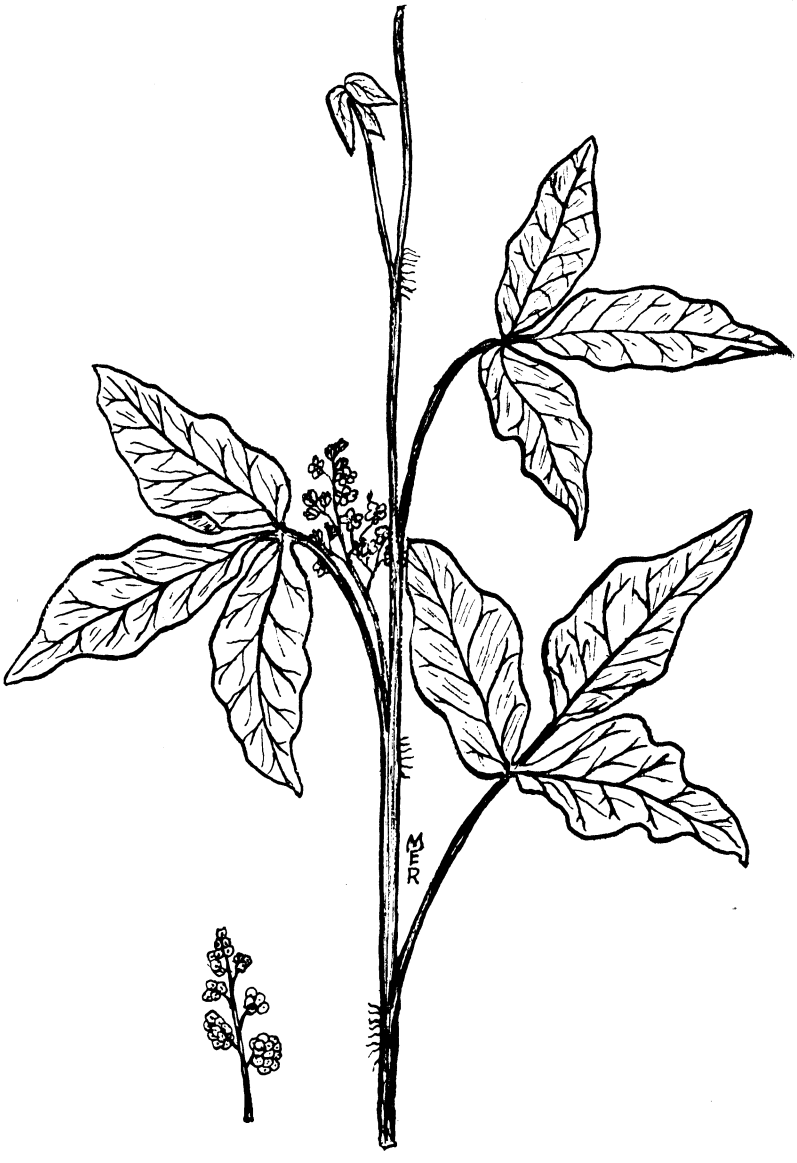

Fig. 17
Toxicodendron radicans (Poison Ivy)

Control.—Close, frequent mowing of waste ground, spring weeding of infested grainfields, and clean cultivation will bring it under control.

Note.—This plant has some forage value.

111. **Vicia hirsuta** (L.) Koch. Hairy Vetch.— Weak, slender, trailing stem; alternate, pinnately compound, tendril-bearing leaves with small, linear, often toothed stipules at the base of the short petioles; 12-14 oblong to linear-oblong, blunt or slightly notched, minutely bristle-tipped leaflets; and bluish-purple flowers in loose, 1-6-flowered, axillary clusters mostly shorter than the leaves. The fruit is an oblong, short-stalked, 2-seeded pod. This plant is smooth or sparingly hairy.

Annual introduced from Europe; propagated by seeds. Flowering period: late spring to early fall.—Chiefly in meadows and waste ground; reported from several counties.

Control.—Same methods as for cow vetch.

Note.—This plant has forage value.

CRASSULACEAE. Orpine Family

112. **Sedum triphyllum** (Haw.) S. F. Gr. (*Sedum telephium* L., *Sedum purpureum* Tausch.) Live-forever. Garden Orpine.— Smooth, frequently purplish, stout, erect, simple stem; numerous, alternate, sessile or very short-petioled, ovate or broadly oval, blunt, coarsely toothed, fleshy, light green leaves; and purple flowers in dense, head-like, terminal clusters. The 5 petals are twice as long as the ovate pointed sepals. The fruit is composed of 5 spreading carpels, each tipped by a short, persistent style.

Perennial introduced from Europe; propagated sparingly by seeds, mostly by thick, tuber-like rootstocks and by rooting at the nodes. Flowering period: summer and early fall.—Formerly a cultivated plant in gardens and cemeteries, now escaped from cultivation to roadsides, fields, and waste ground; reported from several Ohio counties.

Control.—Starve out the underground parts by close, repeated hoe-cutting, supplemented by salting. Cut stems should be composted or dried and burned to prevent rooting at the nodes.

ANACARDIACEAE. Sumac Family

113. ****Toxicodendron radicans** (L.) Ktz. (*Rhus radicans* L., *Rhus toxicodendron* L.) Poison Ivy. Three-leaf Ivy.— Sometimes shrubby but more often climbing or trailing woody stem, attached by aerial rootlets; alternate, petioled, compound leaves; each leaf composed of 3 ovate or rhombic, pointed, entire or sparingly toothed leaflets, the lateral ones nearly sessile, the terminal one stalked; and small greenish-white flowers in loose, branched, axillary clusters. The fruit is a smooth, gray or greenish, globose-oblong, 1-seeded drupe.

Native perennial, propagated by seeds and by long rootstocks from which new plants grow at intervals. Flowering period: late spring and early summer; the fruits remain till winter.—Along roadsides, fences, walls, around trees, and waste places; general and abundant in Ohio.

Control.—A single spray application of sodium chlorate at a dilution of one pound to a gallon of water and applied at the rate of from 2 to 3 pounds to the square rod has proven effective. It may be applied at any time during the season. A later clean-up application is sometimes necessary to kill sprouts from the more resistant plants.

A saturated solution of salt prepared by dissolving approximately 3 pounds in each gallon of water is fairly effective for killing the foliage of poison-ivy. The first application should be made during early summer; several later applications will be necessary to kill the new foliage which will continue to appear until the underground parts have been starved out.

Poison ivy can be destroyed by plowing and clean cultivation in the few situations where such methods are practicable.

Grubbing is sometimes necessary for small areas adjacent to valuable shrubbery or trees that would suffer injury from a chemical application. Parts of the body that are liable to come in contact with the plant should be well protected during the operation.

Notes.—The fruits are scattered widely by birds. All parts of the plant, but especially the leaves, contain a non-volatile oil that in most cases causes inflammation, itching, and burning of the skin as a result of contact with the plants or with objects previously in contact with them.

CANNABINACEAE. Hemp Family

114. **Cannabis sativa** L. Hemp.— Rather stout, tall, erect stem with upright branches; petioled, digitately compound leaves, the lower ones opposite, the upper alternate; each leaf composed of 3-11 lance-shaped or linear lance-shaped, sharply toothed leaflets, pointed at

both ends; and small, green flowers, the staminate ones in loose, slender, branched, axillary clusters, the fertile ones in small, erect, spike-like, axillary clusters. The small, ovoid fruit is hard and brittle. This strong-scented, rough-hairy plant has resinous-speckled leaves and tough, fibrous, inner bark.

Introduced annual, propagated by seeds. Flowering period: summer and early fall.—A weed of barnyards, stockyards, waste ground, and sometimes cultivated ground; reported from several counties.

Control.—Prevent seed production by hand methods or by clean cultivation.

URTICACEAE. Nettle Family

115. **Urtica dioica** L. Stinging Nettle. Great Nettle.— Rather stout, erect, hollow stem; opposite, ovate, 3-5-nerved, coarsely toothed, pointed leaves with a heart-shaped base, borne on slender petioles less than half as long as the leaf breadth; lance-shaped stipules; and small, green flowers in large, branched clusters in the upper axils. The staminate and fertile flowers are usually borne on separate plants. The small, ovate, compressed fruit is enclosed in the persistent calyx. The stem and leaves are beset with stinging hairs.

Perennial introduced from Europe; propagated by seeds. Flowering period: summer and early fall.—A weed along roadsides and in waste ground; reported from several counties.

Control.—Same methods as for slender nettle.

116. **Urtica gracilis** Ait. Slender Nettle. Tall Nettle.— Slender, erect, hollow stem, simple or with a few ascending branches; opposite, lance-shaped to broadly lance-shaped, 3-5-nerved, coarsely and deeply toothed, long-pointed leaves borne on slender petioles more than half as long as the leaf breadth; lance-shaped stipules; and small, green flowers in branched, axillary clusters. The staminate and fertile flowers are usually borne on the same plant. The fruit is similar to that of the preceding species. The stem and leaves are sparsely beset with stinging hairs.

Native perennial, propagated by seeds and by rootstocks. Flowering period: summer and fall.—A weed in barnyards, roadsides, fencerows, thickets, and waste places; occasionally in meadows and gardens; most troublesome in moist fertile soils; general distribution in Ohio.

Control.—Prevent seeding and destroy or starve out the underground parts. Digging for scattered plants and hoe-cutting, supplemented by salting, for small patches are effective. Infested waste land should be mowed several times during the season. Clean cultivation is satisfactory.

ONAGRACEAE. Evening-primrose Family

117. **Isnardia palustris** L. (*Ludwigia palustris* (L.) Ell.) Marsh-purslane. Water-purslane.— Smooth, frequently reddish, succulent, prostrate or floating stem, rooted at the nodes; small, opposite, oval to spatula-shaped, entire leaves narrowed to short, slender petioles; and very small, solitary, sessile, axillary flowers. The calyx has 4 triangular lobes; the corolla has 4 small, reddish petals or it is wanting. The fruit is a small, 4-sided, flat-topped capsule.

Native perennial, propagated by seeds and by rooting at the nodes. Flowering period: summer and fall.—In ditches, wet meadows, or pastures, and swamps; frequently a troublesome weed in muck land; general distribution in Ohio.

Control.—Practice digging or hand-pulling before bloom. Large areas should be mowed several times during the season.

118. **Oenothera biennis** L. (*Onagra biennis* (L.) Scop.) Common Evening-primrose.— Rather stout, erect, simple or branched stem; alternate, lance-shaped to ovate lance-shaped, slightly wavy-toothed, pointed leaves, the lowest ones narrowed to a petiole, the stem leaves sessile; and large, sessile, night-blooming, pale yellow flowers in long, leafy, terminal spikes. The long, slender calyx-tube has 4 lance-shaped lobes; the 4 petals are broad and spreading. The fruit is a hairy, oblong, somewhat 4-angled capsule narrowed toward the top and containing 4 cavities. The stem and leaves are usually covered with short, stiff hairs.

Native biennial, propagated by seeds. Flowering period: summer and fall.—In pastures, meadows, along streams, roadsides, fencerows, and waste places; thrives in dry sandy soils; general distribution in Ohio.

Control.—Prevent seed production. Practice spudding or hoe-cutting of the rosettes below the crown during fall or spring, and hand-pulling or low cutting of the flower-stalks. The plants tend to stool freely after mowing. Plants with partly ripe fruits should be dried and burned to prevent ripening on the stalk. This weed succumbs readily to cultivation.

CONVOLVULACEAE. MORNING-GLORY FAMILY

119. ***Ipomoea purpurea** (L.) Lam. Common Morning-glory.— Twining or trailing stem covered with backwardly turned hairs; alternate, slender-petioled, broadly ovate, pointed, entire, lightly hairy leaves, heart-shaped at the base; and large, showy, purple, pink, or white, funnel-shaped flowers, 1-5 together in axillary clusters. The depressed-globose fruit is shorter than the hairy lance-shaped sepals. This plant has milky sap.

Annual introduced from tropical America; propagated by seeds which may remain viable in the soil for several years. Flowering period: summer and fall.—Formerly cultivated as an ornamental but escaped in gardens, cultivated fields, and waste ground; general distribution in Ohio.

Control.—Prevent seed production until the end of the season by hand methods or clean cultivation, supplemented by hand-pulling or deep hoe-cutting. The knife or sweep type of cultivator blade is most effective against such plants. The uneven germination of buried seeds over a period of years often accounts for the reappearance of this weed each time the land is broken up.

120. ***Ipomoea hederacea** Jacq. Ivy-leaf Morning-glory. Field Morning-glory.— Twining or trailing stem densely covered with backwardly turned hairs; alternate, long- and slender-petioled, rounded-ovate, hairy leaves with 3 large, pointed lobes; and showy, funnel-shaped flowers, smaller than those of the preceding species, borne 1-3 together in axillary clusters. The lower part of the corolla is whitish but the upper part is blue or purple. The fruit is similar to that of the preceding species but is considerably shorter than the long lance-shaped sepals. This plant has milky sap.

Annual introduced from tropical America; propagated by seeds which remain viable in the soil for several years. Flowering period: summer and fall.—In gardens, cultivated fields (especially corn), and waste ground; a weed especially in the southwestern part of Ohio.

Control.—Same methods as for common morning-glory.

121. ***Convolvulus arvensis** L. Field Bindweed.— Smooth, slightly angled, slender, twining or trailing, simple or branched stem; alternate, slender-petioled, smooth, ovate or oblong, entire, pointed or bristle-tipped leaves with spreading, arrow-shaped, basal lobes; and funnel-shaped, pink or nearly white flowers, borne 1-4 together in stalked, axillary clusters. The calyx is without bracts. The small, globose fruit has 1-4 cavities.

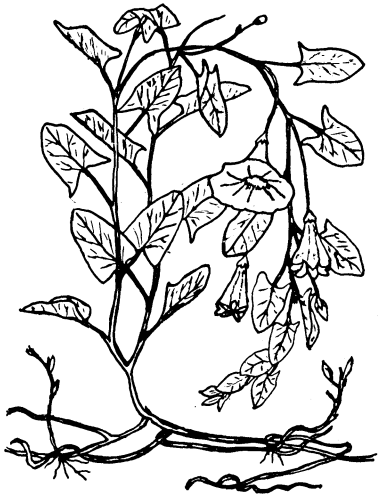

Fig. 18

Convolvulus arvensis (Field Bindweed)
After Clark and Fletcher

Perennial, naturalized from Europe; propagated to some extent by seeds, but chiefly by creeping, horizontal roots that produce new shoots from adventitious buds. Flowering period: summer months.—In cultivated fields, gardens, meadows, waste places, and along railroads; most troublesome in moist, fertile soils; general distribution in Ohio.

Control.—Consult the section on methods of control and eradication for certain noxious perennial weeds.

Notes.—This weed resists eradication because of the longevity of the brittle, fleshy underground parts that are frequently broken off and carried to uninfested ground during cultivation. The twining, mat-like top growth chokes out and pulls down crop plants.

122. **Convolvulus sepium** L. Hedge Bindweed. Great Bindweed.— Smooth, slender, twining or trailing stem; alternate, slender-petioled, smooth, triangular, pointed leaves with divergent, rather pointed, slightly toothed or entire, basal lobes; and large, showy, funnel-shaped, stalked, pink and white striped or white flowers, solitary in the axils. The calyx is subtended by 2 large, ovate bracts. The fruit is similar to that of the preceding species.

Native perennial, propagated by seeds which may remain viable for several years, and by long, creeping, underground stems that produce new shoots at the nodes. Flowering period: summer months.—In cultivated fields (especially corn on bottom land), gardens, meadows, grainfields, roadsides, and waste places; general distribution in Ohio.

Control.—Consult the section on methods of control and eradication for certain noxious perennial weeds.

CUSCUTACEAE. DODDER FAMILY

123. **Cuscuta epilinum** Weihe. Flax Dodder.— Thread-like, twining, yellow stems; alternate, minute, scale-like leaves; and small, sessile, yellowish flowers in dense clusters. The stigmas are slender; the urn-shaped corolla is 5-lobed; the short, erect, corolla-scales are fringed only above. The fruit is a small, globose capsule that opens by a lid and contains 1-4 small, brown seeds.

The dodders are thread-like, twining, leafless stem-parasites without green coloring matter that secure food through minute disc-like suckers attached to the host plant. The small seeds germinate in the soil, but, after the plantlet attaches itself to its host, the root and lower part of the stem soon perish. The swaying, thread-like stems become attached to other plants, are broken off, and form separate plants, so that the growth from a single seed often covers a considerable area. The host plant is deprived of food and often killed.

Annual introduced from Europe; propagated by seeds. Flowering period: summer months.—It is chiefly parasitic on flax plants.

Control.—Same methods as for field dodder.

124. ***Cuscuta epithymum** Murr. Clover Dodder. Thyme Dodder.— Thread-like, yellow or reddish stems; and small, sessile, whitish or pinkish flowers in small, dense clusters. The stigmas are slender; the bell-shaped corolla is 4-5-lobed; the strongly incurved corolla-scales are fringed all around. The fruit is similar to that of the preceding species.

Annual introduced from Europe; propagated by seeds which retain their vitality in the soil for several years. Flowering period: summer and early fall.—It is parasitic on clover and alfalfa.

Control.—Same methods as for field dodder.

125. ***Cuscuta arvensis** Beyrich. Field Dodder. Alfalfa Dodder.— Thread-like, often high-climbing, pale yellow stems; and small, very nearly sessile, white flowers in small, dense clusters. The 5 calyx-lobes are broad and blunt; the bell-shaped corolla has 5 pointed lobes; the stigmas are knob-like; the ovate corolla-scales are fringed all around. The fruit is a somewhat depressed-globose capsule with the corolla persistent at the base; it does not open by a lid.

Native annual, propagated by seeds. Flowering period: summer and early fall.—It is parasitic on clover, alfalfa, and a number of uncultivated herbs and low shrubs.

Control.—Small patches of dodder in clover and alfalfa fields should be destroyed by mowing and burning before the flowers open. Close mowing is essential, and it is important to begin well beyond the margin of the infested area to avoid missing small dodder plants. After drying, the plants should be burned, preferably after sprinkling with kerosene or covering with dry straw. A kerosene burner or blow torch may be used. Patches that are mowed and burned after the dodder has produced seeds should be given shallow cultivation with hoe and rake at intervals during the remainder of the season to induce germination and destroy dodder seedlings. The field should be inspected regularly during the remainder of the season, as well as the following year.

The following measures are advisable for large areas where dodder has not matured seeds: The field may be cut for hay, which should be fed in the field to prevent scattering the dodder on clean areas. Grazing closely from the first appearance of dodder to the end of the season is another method. Plowing under the crop for green manure is a good method, providing it is done before the dodder has seeded. Dodder seeds will remain viable in the soil for 4 or 5 years.

The following methods are applicable to fields in which a heavy infestation of dodder has been allowed to produce a crop of seed: In case the legume crop is worth saving, it should be mowed closely, stacked, and fed in the field. The field should be grazed closely during the rest of the season; grazing throughout the season or early cutting before the dodder has seeded, followed by grazing, is advisable during the next season. On the other hand, a field that is so badly infested that it is worthless for a crop should be mowed closely, dried, and burned. Burning kills many seeds on the soil, as well as the plants.

Clover or alfalfa fields to which either of the above methods has been applied should then be put under a rotation that includes crops not attacked by dodders. Corn, small grains, soybeans, and cowpeas are satisfactory. Clover and alfalfa should be left out of the rotation for 4 or 5 years.

126. **Cuscuta gronovii** Willd. Gronovius' Dodder. Onion Dodder.— Thread-like, high-climbing, yellow to orange stems; and numerous, small, short-stalked, bell-shaped, white flowers in dense clusters. Both the calyx- and corolla-lobes are blunt or rounded at the apex; the stigmas are knob-like; the long corolla-scales are fringed thickly above but sparingly along the sides. The fruit is a globose, short-pointed capsule enclosed in the withered, finally deciduous corolla; it does not open by a lid.

Native annual, propagated by seeds. Flowering period: summer and early fall.—It is parasitic on a large number of herbs and shrubs, including onions and some garden ornamentals; most abundant in moist shady places; general distribution in Ohio.

Control.—Prevent seed production by mowing and burning the uncultivated host plants, especially patches that are adjacent to susceptible cultivated plants.

HYDROPHYLLACEAE. Water-leaf Family

127. **Phacelia purshii** Buckl. Pursh's Phacelia. Miami-mist.— Sparsely hairy, angled, slender, erect, generally much branched stem; alternate, short-petioled or sessile, clasping leaves, pinnately divided into lance-shaped, toothed or entire segments; and small, stalked, blue or white flowers in 1-sided, terminal clusters. The calyx has 5 lance-shaped segments; the wheel-shaped corolla has 5 fringed lobes. The fruit is a small globose-ovoid capsule.

Native annual or biennial, propagated by seeds. Flowering period: spring and early summer.—A weed of cultivated ground, especially gardens, as well as waste places; general distribution in Ohio.

Control.—Prevent seed production by hand-pulling or hoeing before bloom, and by clean cultivation of a hoed crop.

APOCYNACEAE. Dogbane Family

128. **Vinca minor** L. Periwinkle.— Smooth, trailing, slightly woody stem; opposite, short-petioled, oblong or ovate, entire, firm, smooth, evergreen leaves; and rather large, solitary, axillary, slender-stalked, blue flowers. The calyx has 5 narrowly lance-shaped segments; the cylindric corolla-tube is expanded above into 5 spreading, wedge-shaped lobes. The slender, cylindric fruits are borne in pairs. This plant has milky sap.

Perennial naturalized from Europe; propagated by seeds and by extensive, creeping root-stocks. Flowering period: spring and summer.—Formerly cultivated as an ornamental plant and now an escape about gardens, cemeteries, and along roadsides; rather general distribution in Ohio.

Control.—Prevent seed production and remove or starve out the underground parts. Close mowing, hoe-cutting, or digging before bloom, supplemented by salting to prevent sprouting, and repeated hoe-cutting throughout one or more seasons are advisable control practices.

129. **Apocynum androsaemifolium** L. Spreading Dogbane.— Smooth, somewhat woody, slender, erect stem, usually with widely spreading branches; opposite, short-petioled, ovate or oval, pointed or bristle-tipped, entire leaves, smooth and green above but paler, as well as generally hairy, beneath; and small, stalked, bell-shaped, nodding, pinkish flowers in terminal and axillary clusters. The calyx has 5 ovate or lance-shaped segments shorter than the corolla-tube; the bell-shaped corolla has 5 spreading or downwardly curved lobes. The long, round, slender, curved, paired fruits contain numerous, flat seeds, each tipped with a tuft of silky hairs. This plant has acrid, milky sap.

Native perennial, propagated by seeds, which are widely distributed by winds and by horizontal, creeping roots. Flowering period: summer months.—Chiefly a weed of meadows, vineyards, roadsides, thickets, and waste places; general distribution in Ohio.

Control.—Control methods consist of grubbing or hoe-cutting before bloom, supplemented by salting to prevent sprouting; repeated hoe-cutting or close mowing to starve out the roots; clean cultivation of a hoed crop; shallow plowing in hot, dry weather to expose the roots, followed by surface cultivation at weekly intervals throughout the season.

130. ***Apocynum cannabinum** L. (Incl. *A. album* Greene.) Indian-hemp. Dogbane.— Smooth, somewhat woody, slender, erect stem, with numerous, ascending branches; opposite, short-petioled or sessile, oblong to ovate lance-shaped, pointed or bristle-tipped, entire leaves,

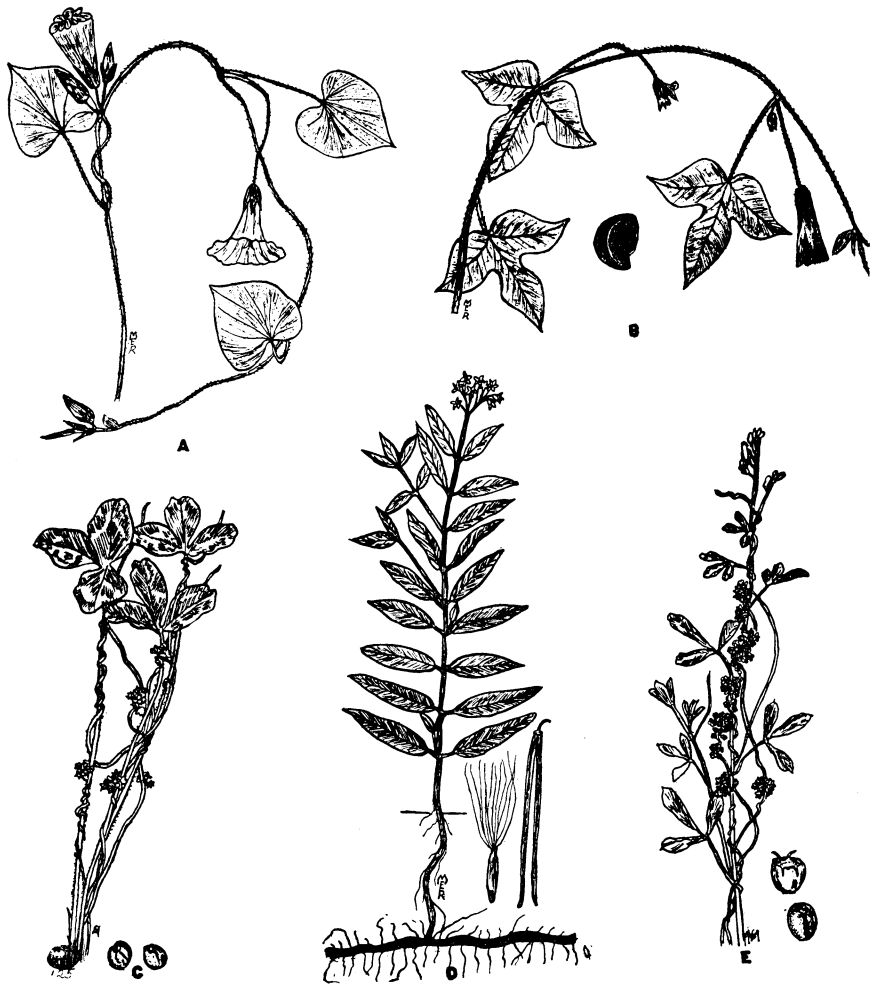

Fig. 19

a. **Ipomoea purpurea** (Common Morning-glory)
b. **Ipomoea hederacea** (Ivy-leaf Morning-glory)
c. **Cuscuta arvensis** (Field Dodder)
After Beal.
d. **Apocynum cannabinum** (Indian-hemp)
e. **Cuscuta epithymum** (Clover Dodder)
After Beal.

smooth above, but paler, as well as often lightly hairy, beneath; and small, stalked, urn-shaped, greenish-white flowers in dense, nearly erect, terminal or axillary clusters. The calyx has 5 segments about as long as the corolla-tube; the corolla has 5 nearly erect lobes. The paired fruits are similar to those of the preceding species. This plant has milky sap.

Native perennial, propagated by seeds and by numerous, horizontal, creeping roots. Flowering period: summer months.—In meadows, pastures, thickets, roadsides, and waste places; especially troublesome in moist, fertile land; general and abundant in Ohio.

Control.—Same methods as for spreading dogbane.

ASCLEPIADACEAE. Milkweed Family

131. ***Asclepias syriaca** L. Common Milkweed.— Stout, erect, generally simple stem, finely hairy, at least toward the top; opposite, stout- and short-petioled, large, oblong or ovate, pointed or bristle-tipped, entire leaves, smooth above but downy-hairy beneath; and showy, long-stalked, greenish-purple or pinkish flowers in dense, head-like, terminal or axillary clusters. The calyx and corolla are 5-lobed. The large, ovoid, long-pointed, densely downy-hairy fruit is covered with soft, awl-shaped processes and contains many, flat, brown seeds, each tipped with a long tuft of silky hairs. This plant has milky sap.

Native perennial, propagated by seeds, which are readily disseminated by wind and water, and by horizontal, creeping roots. Flowering period: summer months.—Chiefly a weed of pastures, roadsides, and waste ground; general and abundant in Ohio.

Control.—Prevent seed production and starve out the underground parts. Practice repeated close mowing or hoe-cutting throughout the season. Both methods may be supplemented by salting to prevent sprouting. Deep plowing and clean cultivation of a tilled crop are advisable.

SOLANACEAE. Potato Family

132. ***Datura stramonium** L. (Incl. *Datura tatula* L.) Common Jimson-weed. Jamestown-weed. Stramonium. Thorn-apple.— Stout, green or purplish, simple or branched stem, smooth or the young parts slightly hairy; large, alternate, stout-petioled, smooth, pointed leaves, ovate or oval in shape but irregularly and sharply angle-lobed, often inequilateral at the base; and large, short-stalked, solitary, funnel-shaped, white or violet flowers. The angled, tubular, 5-lobed calyx is about half the length of the funnel-shaped, 5-lobed corolla-tube. The ovoid fruit is covered with numerous, stiff prickles.

Annual naturalized from the tropics; propagated by seeds. Flowering period: summer and early fall.—Chiefly a weed of farmyards and waste places; general distribution in Ohio.

Control.—Prevent seed production by hoeing or mowing before bloom.

Notes.—All parts of the plant, especially the seeds, are poisonous, but it is generally avoided by animals because of the disagreeable odor and taste. The numerous seeds remain viable for a considerable time.

133. **Lycium halimifolium** Mill. (*Lycium vulgare* (Ait. f.) Dunal.) Matrimony-vine.— Woody, slender, branched, often spiny, climbing or trailing stem; small, smooth, alternate, lance- or spatula-shaped, entire leaves narrowed to short petioles, as well as smaller ones fascicled in the axils; and small, slender-stalked, purplish or greenish flowers, solitary or several together in the axils. The calyx has 3-5 ovate, pointed lobes; the funnel-shaped corolla has 5 ovate-oblong lobes. The fruit is an oval, orange-red berry.

Perennial introduced from Europe; propagated by seeds. Flowering period: late spring and summer.—Often cultivated as an ornamental and escaped around dwellings, and in waste places; rather general distribution in Ohio.

Control.—Grubbing, repeated close cutting, or a heavy application of salt are advisable as control measures.

134. **Physalodes physalodes** (L.) Britt. (*Nicandra physalodes* (L.) Pers.) Apple-of-Peru.— Smooth, angled, erect, branched stem; large, alternate, petioled, ovate to oblong, deeply wavy-toothed leaves gradually tapered to a blunt tip, narrowed at the base; and large, solitary, terminal or axillary, stalked, nodding, broadly bell-shaped, light blue flowers. The fruit is a nearly dry, globose berry enclosed in the 5 arrow- or heart-shaped, netted-veined calyx-segments.

Annual introduced from Peru; propagated by seeds. Flowering period: summer and fall.—Formerly cultivated as a garden ornamental and escaped around buildings, along roadsides, and in waste ground; reported from several counties of Ohio.

Control.—Prevent seeding by hand-pulling, hoeing, or close mowing before bloom.

135. ***Solanum carolinense** L. Horse-nettle. Sand-brier.— Erect, branched stem; alternate, stout-petioled leaves, oblong or ovate in shape but coarsely wavy-toothed or

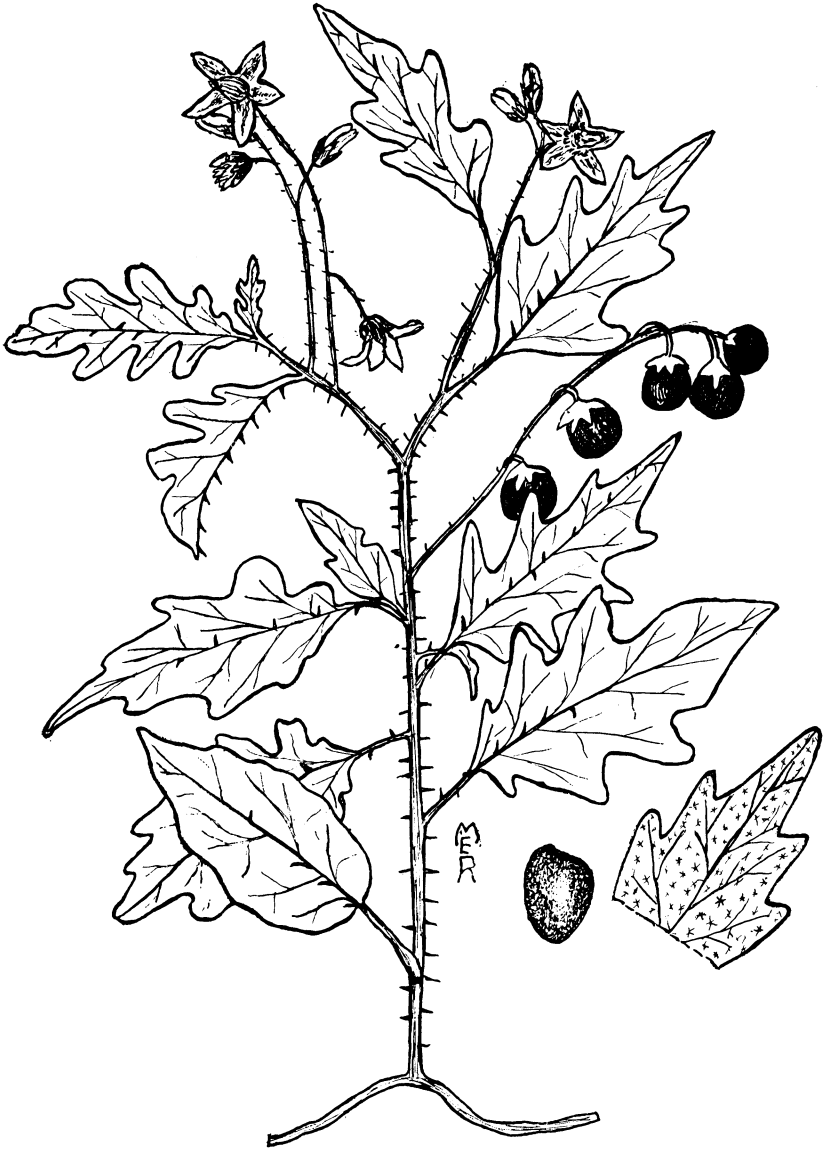

Fig. 20
Solanum carolinense (Horse-nettle)

pinnately lobed; and stalked, pale violet or whitish flowers in loose clusters which at first appear as if terminal, but become lateral as the stem lengthens. The calyx has 5 lance-shaped lobes and is persistent at the base of the fruit; the wheel-shaped corolla has 5 ovate lance-shaped lobes. The fruit is a smooth, globose, pulpy, many-seeded, yellow berry. The entire plant is densely covered with star-shaped hairs; the stems, petioles, flower-stalks, mid-ribs, and often the lateral veins are beset with yellow, awl-shaped prickles.

Native perennial, propagated by seeds and by deep, creeping roots. Flowering period: late spring to early fall.—A noxious weed in cultivated land and permanent pastures; to a less extent in meadows, roadsides, and waste places; especially troublesome in fairly dry, sandy soils; general distribution in Ohio.

Control.—The following methods are suitable for small patches of horse-nettle: The perennial roots can be starved out by hoe-cutting the tops throughout the season as often as they appear above the soil. Cutting and salting at the rate of one pound to a square foot has been reported as satisfactory by Hansen at the Indiana Station; salting is too expensive for large areas. Waste crankcase oil may be used in place of salt. Both materials render the soil sterile for a time. Smothering with materials such as heavy tar paper or tin roofing is another effective method.

Horse-nettle on tillable land can be killed out by a combination of cultivated and smother crops. On heavily infested land the crop should be regarded as of secondary importance until control has been accomplished. The field should be plowed early, thoroughly prepared, and planted to corn in check rows. Frequent cultivation should be supplemented by hoeing, especially after the crop has been laid by. The perennial roots can only be starved out by destroying the green shoots as often as they appear at the soil line. The sweep type of blade is preferable in soils loose enough to permit its use. When the weed is in patches, the cultivator should be cleaned before moving to uninfested areas.

The field may be left bare during the winter or planted to a cover crop, such as rye. Either a cultivated or smother crop may follow. The former is preferable in case the horse-nettle is still abundant; a smother crop will suffice where the weed is well under control.

Bare fallowing is a last resort for fields so heavily infested that a profitable crop is impossible. A tilled crop should follow the next season, and a smother crop the following one.

Large areas in permanent pastures and waste land should at least be mowed several times during the season.

Note.—Sheep sometimes eat the fruits, thereby scattering the seeds to uninfested areas.

136. ***Solanum nigrum** L. Black Nightshade. Common Nightshade.— Erect, slender stem with ascending or spreading branches; alternate, slender-petioled, dark green, ovate, pointed leaves, somewhat inequilateral, entire or wavy-toothed, narrowed or rounded at the base; and small, stalked, white flowers, several together in loose, rather flat-topped, drooping, lateral clusters. The calyx has 5 oblong, blunt lobes, is much shorter than the 5-lobed, wheel-shaped corolla, and is persistent at the base of the fruit. The fruit is a small, smooth, globose berry that is black when ripe. The plant is either smooth or lightly covered with simple, or sometimes star-shaped, hairs.

Native annual, propagated by seeds. Flowering period: summer and fall.—In pastures, waste places, around dwellings, sometimes in meadows, and cultivated ground; general and abundant in Ohio.

Control.—Prevent seeding by pulling or close cutting before bloom. Plants bearing fruits should be dried and burned or composted to destroy the seeds.

Notes.—This plant contains varying amounts of two poisonous compounds, probably most abundant in the unripe fruits. No part of the plant should be used for food, regardless of the fact that the ripe berries have sometimes been eaten without ill effects.

137. **Solanum rostratum** Dunal. Buffalo-bur. Bull-nettle.— Erect, freely branched stem; alternate, stout-petioled leaves, ovate or oval in shape, but either pinnately 5-7-lobed or 1-2 times pinnately divided, resembling in outline the leaves of watermelon; and stout-stalked, yellow flowers in loose, erect, lateral clusters. The wheel-shaped corolla has 5 ovate, pointed lobes; the calyx is densely covered with long, stiff prickles and completely encloses the fruit. The whole plant is covered with star-shaped hairs; the stem, petioles, flower-stalks, and veins are densely beset with yellow, awl-shaped prickles.

Native annual introduced from the West; propagated by seeds. This plant sometimes breaks off and forms a tumbleweed, thus scattering the seeds over a considerable area. Flowering period: summer and fall.—A weed of cultivated and waste ground, as well as meadows and pastures; reported from several Ohio counties.

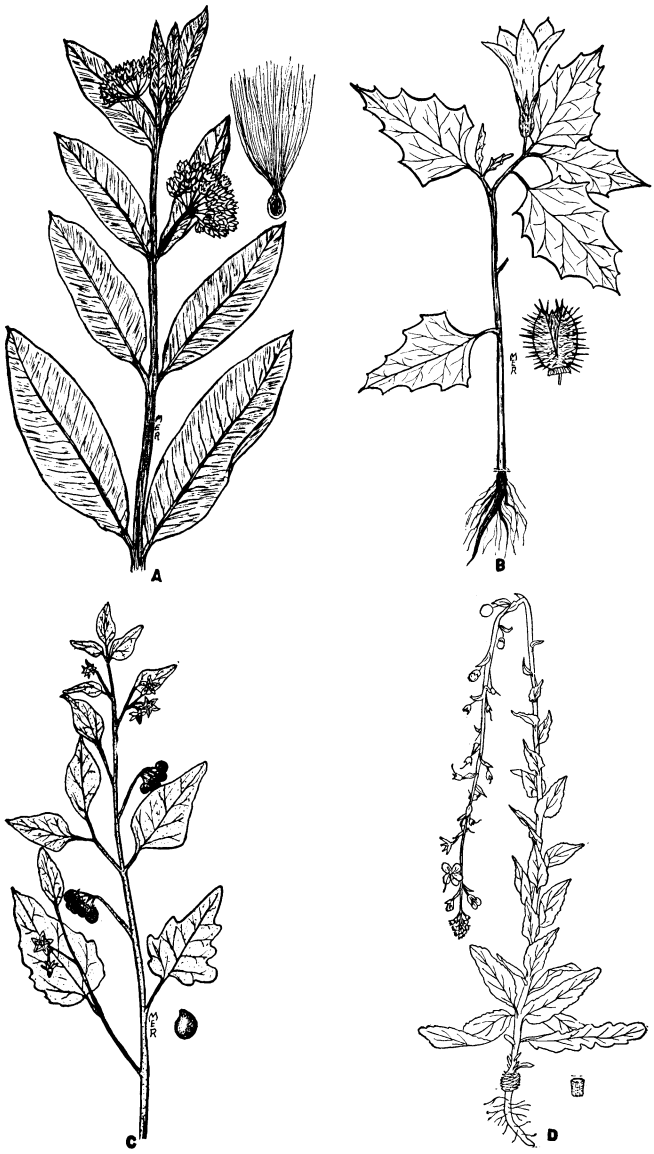

Fig. 21

a. **Asclepias syriaca** (Common Milkweed)
b. **Datura stramonium** (Common Jimson-weed)
c. **Solanum nigrum** (Black Nightshade)
d. **Verbascum blattaria** (Moth Mullen)
After Selby.

Control.—Prevent seed production by hoeing, mowing, or clean cultivation. Plants with partly mature fruits should be burned.

SCROPHULARIACEAE. FIGWORT FAMILY

138. **Verbascum blattaria** L. Moth Mullen.— Erect, slender, usually simple stem, smooth or lightly glandular-hairy toward the top; smooth, alternate, double-toothed, sometimes pinnatifid, pointed leaves, the basal ones oblong, sessile, or tapered to petioles, arranged in a rosette; the stem leaves sessile, ovate or lance-shaped, clasping; and 5-lobed, wheel-shaped, yellow or white flowers on spreading, glandular-hairy stalks, forming a long, open, terminal cluster. The flattened-globose, many-seeded fruit is longer than the 5-lobed calyx.

Biennial naturalized from Europe; propagated by seeds of which it produces an abundance. Flowering period: summer and fall.—A weed in meadows (especially timothy), pastures, roadsides, and waste places; general and abundant in Ohio.

Control.—Spudding or hoe-cutting the rosettes below the crown during fall or early spring is satisfactory for small areas. The flower-stalks should be pulled or cut close before bloom. Badly infested meadows are best put under cultivation.

139. **Verbascum thapsus** L. Common Mullen. Woolly Mullen. Great Mullen.— Stout, tall, erect stem, simple or with a few erect branches; alternate, oblong, pointed, thick, light green leaves, the basal ones sometimes tapered to margined petioles, arranged in a spreading rosette; the stem leaves smaller and narrowed to the base which extends down the stem making it wing-angled; and sessile, wheel-shaped, yellow flowers in long, dense, spike-like, terminal clusters. The globose-oblong fruit is slightly longer than the 5-lobed calyx. The entire plant is densely covered with long, branched, woolly hairs.

Biennial naturalized from Europe; propagated by seeds. Flowering period: summer and fall.—A weed of permanent pasture, recently cleared land, and waste places; thrives in dry, sandy, or gravelly soils; general and abundant in Ohio.

Control.—Same methods as for moth mullen.

140. **Pentstemon digitalis** (Sweet) Nutt. (*Pentstemon laevigatus digitalis* (Sweet) Gr.) Foxglove Beard-tongue.— Rather stout, frequently reddish, erect stem, simple or with basal branches; opposite, entire or sharply and finely wavy-toothed, smooth, light green leaves, the basal and lower ones oblong, narrowed to margined petioles; the upper leaves ovate to lance-shaped, sessile, clasping the stem; and showy, stalked, tubular, white or purplish flowers in a slender, many-flowered, branched, terminal cluster. The calyx has 5 lance-shaped segments; the inflated corolla has a 2-lobed upper lip and a 3-lobed lower one. The ovoid fruit has 2 cavities containing numerous seeds. This plant is usually smooth except for the glandular-hairy inflorescence.

Native perennial, propagated by seeds. Flowering period: late spring and summer.—Chiefly in meadows, pastures, and waste places; rather general distribution in Ohio.

Control.—Practice digging, hand-pulling, or repeated close mowing. Badly infested fields should be put under cultivation.

141. **Veronica officinalis** L. Common Speedwell.— Softly hairy stem, reclining but with the end ascending, generally rooted at the lower nodes; mostly opposite, oval or obovate, blunt, finely toothed, small, softly hairy leaves, narrowed to short, margined petioles; and small, short-stalked, pale blue flowers in long, slender, dense, spike-like, axillary clusters on the erect, flowering stems. The calyx usually has 4 segments; the wheel-shaped corolla is 4-lobed. The fruit is a small, heart-shaped capsule with 2 cavities.

Native perennial, propagated by seeds and by runners. Flowering period: late spring and summer.—Chiefly a weed in dry, upland pastures, open woods, and waste ground; general and abundant in Ohio.

Control.—Small patches in pastures and waste ground may be killed out by repeated hoe-cutting. Where practicable, badly infested fields should be put under cultivation. Smother crops are helpful. Top-dressing and reseeding of thin, infested pastures will accomplish somewhat the same result by encouraging a good growth of grass. The plants are usually too short to permit of effective mowing.

Note.—This weed grows in patches often dense enough to crowd out grasses.

142. **Veronica serpyllifolia** L. Thyme-leaf Speedwell.— Smooth or slightly hairy, reclining stem with ascending, basal branches, generally rooted at the nodes; nearly smooth, opposite, oblong to ovate, blunt, minutely scallop-toothed or entire leaves, the lower ones short-petioled, the upper sessile; and small, short-stalked, blue or white flowers in the axils

of small, lance-shaped, alternate bracts forming short, slender clusters at the ends of the erect, flowering stems. The flowers are like those of the preceding species in structure. The fruit is a small, broadly heart-shaped capsule, about as high as the calyx.

Native or introduced perennial, propagated by seeds and by rooting at the nodes. Flowering period: mostly spring and summer.—A weed in pastures, lawns, and waste ground; general distribution in Ohio.

Control.—Patches in lawns can be killed out by an application of sodium chlorate solution. The solution is prepared by dissolving 1 to 2 ounces of sodium chlorate in each gallon of water. Refer to the discussion given under ground-ivy for suggestions as to the time, rate, and method of application. Digging is not advisable for lawns.

Consult the control measures given for common speedwell.

Note.—This weed is often a troublesome invader in lawns, where it forms patches sufficiently dense to crowd out the grasses.

143. **Veronica peregrina** L. Purslane Speedwell.— Smooth or lightly glandular-hairy, ascending or erect, simple or basally-branched stem; small, smooth leaves, the lowest ones opposite, short-petioled, oblong or ovate, finely toothed; the upper leaves alternate, sessile, narrowly oblong or linear, mostly entire; and small, short-stalked, nearly white flowers, solitary in the axils of the upper leaves. The fruit is a rounded heart-shaped, many-seeded capsule, usually somewhat shorter than the calyx.

Native annual, propagated by seeds of which it produces a large number. Flowering period: spring to the end of the season.—In cultivated fields, gardens, pastures, roadsides, and waste places; most abundant in moist soils; general distribution in Ohio.

Control.—Prevent seed production by hand methods or by clean cultivation started early in the spring and continued until late in the season. Smother crops are helpful, and a thick, vigorous stand of grasses will largely prevent the annual speedwells from gaining a foothold in pasture land.

144. ***Veronica arvensis** L. Field Speedwell. Corn-speedwell.— Hairy, slender stem, at first simple and erect but later spreading and diffusely branched; opposite, short-petioled or sessile, broadly ovate, blunt, scallop-toothed, lower leaves; alternate, sessile, ovate or lance-shaped, pointed, mostly entire upper leaves; and very small, short-stalked, blue or white flowers, solitary in the axils of the upper leaves. The fruit is a small, heart-shaped, many-seeded capsule. The stem, leaves, and inflorescence are covered with long, glandular hairs.

Annual introduced from Europe; propagated by seeds. Flowering period: spring to the end of the season.—In cultivated fields, gardens, thin grasslands, roadsides, and waste places; general distribution in Ohio.

Control.—Same methods as for purslane speedwell.

145. **Veronica agrestis** L. Garden Speedwell. Procumbent Speedwell.— Slender, creeping or procumbent stem with ascending branches; broadly ovate or oval, blunt, scallop-toothed leaves varying from rounded to heart-shaped at the base, the lowest ones opposite, short-petioled; the uppermost leaves alternate, sessile; and small, solitary, axillary, blue flowers on slender stalks that are as long as the leaves or longer. The fruit is a small, broadly heart-shaped, slightly compressed capsule. The entire plant is hairy.

Annual introduced from Europe; propagated by seeds. Flowering period: late spring to early fall.—The garden speedwell is less common in Ohio than the preceding speedwells, but it may be a weed in similar situations.

Control.—Same methods as for purslane speedwell.

146. **Linaria linaria** (L.) Karst. (*Linaria vulgaris* Hill) Yellow Toadflax. Butter-and-eggs.— Ascending, simple or basally branched, flowering stems; leafy, spreading or procumbent, sterile stems; sessile, mostly linear, pointed leaves, narrowed at the base, alternate on the flowering stems, usually some opposite on the sterile stems; and stalked, yellow flowers in long, slender, terminal or axillary clusters. The irregular, 2-lipped corolla has a long, curved spur at the base. The fruit is an ovoid capsule with 2 cavities containing numerous, wing-margined seeds. The stems and leaves are either smooth or lightly glandular-hairy and are often covered with a slight bloom.

Perennial naturalized from Europe; propagated by seeds and by deep, creeping root-stocks. Flowering period: summer and fall.—Formerly planted around dwellings and in cemeteries but escaped from cultivation to lawns, pastures, meadows, roadsides, and waste places; general distribution in Ohio.

Control.—Repeated deep hoe-cutting to starve out the rootstocks, an application of strong salt brine or crushed rock salt, and fall plowing to expose the underground parts, followed by a cultivated crop the next year, are recommended.

OROBANCHACEAE. Broom-rape Family

147. **Orobanche ludoviciana** Nutt. Louisiana Broom-rape.— Rather stout, solitary or clustered, erect, simple stems; alternate, lance-shaped scale-leaves; and numerous, purplish flowers in dense, terminal spikes. The bracted calyx is deeply 5-cleft into narrowly lance-shaped lobes about as long as the corolla-tube; the oblique corolla is 2-lipped. The fruit is a small, ovoid-oblong capsule filled with numerous, minute seeds. The entire plant is covered with small, glandular hairs. This yellowish or brownish plant lacks chlorophyll and is parasitic on the roots of various plants.

Native annual, propagated by seeds. Flowering period: summer months.—Parasitic on the roots of tobacco and a number of uncultivated plants; grows chiefly in sandy soils; reported from several counties of southwestern Ohio.

Control.—Hoe-cutting and burning before the seeds are ripe are advisable. Tobacco should be left out of the rotation for several years in case a field has become badly infested.

BORAGINACEAE. Borage Family

148. **Lappula lappula** (L.) Karst. (*Lappula echinata* Gilib.) European Stickseed.— Erect, slender stem, branched at the top; alternate, blunt, entire, pale green leaves, the lowest ones spatula-shaped, narrowed into very short petioles; the remaining leaves linear, linear-oblong, or lance-shaped, sessile; and very small, blue flowers in long, slender, more or less 1-sided, leafy-bracted, terminal clusters, each flower on a short stalk that is not deflexed in fruit. The calyx has 5 lance-shaped segments nearly as long as the funnel-shaped, 5-lobed corolla. The fruit is composed of 4 angled nutlets, each with a double row of hooked prickles around the margin. The entire plant is covered with fine, appressed, whitish hairs.

Annual or winter annual introduced from Europe; propagated by seeds. Flowering period: summer and early fall.—Chiefly a weed of pastures, roadsides, and waste places; rather general distribution in Ohio.

Control.—Prevent seed production by hand-pulling, hoe-cutting, or close mowing before bloom. Fall plowing to destroy the autumn rosettes, followed by a tilled crop the next year, is satisfactory.

Notes.—The fruits are readily disseminated by grazing animals. They are injurious to wool.

149. **Lappula virginiana** (L.) Greene. Virginia Stickseed.— Erect, slender stem with spreading branches toward the top; alternate, entire leaves, the basal ones (seldom present at flowering time) long-petioled, ovate or rounded heart-shaped; the stem leaves ovate-oblong, pointed, narrowed at the base, petioled, or the smaller, uppermost ones sessile; and very small, bluish or nearly white flowers in several, long, slender, spreading clusters with bracts only at the base, each flower on a short stalk that is deflexed in fruit. The flowers are similar in structure to those of the preceding species. The fruit is composed of 4 nutlets, each with margin and back covered with slender, barbed prickles. The entire plant is covered with soft, whitish hairs. This plant has only a rosette of leaves the first season.

Native biennial, propagated by seeds. Flowering period: summer and early fall.—Chiefly a weed in wooded pastures, thickets, and waste places; general distribution in Ohio.

Control.—Same methods as for European stickseed.

150. **Cynoglossum officinale** L. Hound's-tongue. Dog-bur.— Stout, erect stem, generally branched above, leafy to the top; alternate, entire leaves, the basal and lower ones oblong, long- and slender-petioled; the upper leaves lance-shaped, pointed, sessile or clasping by an arrow- or heart-shaped base; and short-stalked, reddish, purple or white flowers in long, narrow, simple or branched, terminal clusters. The hairy calyx has 5 narrowly ovate, pointed segments, enlarged and spreading at maturity; the funnel-shaped corolla is 5-lobed. The fruit is composed of 4 nutlets covered with short, barbed prickles and attached laterally below the persistent, awl-shaped style. The stem and leaves are covered with soft, short hairs. Only a large rosette of leaves is formed the first season.

Biennial naturalized from Europe; propagated by seeds. Flowering period: late spring to fall.—Chiefly a weed in pastures and waste ground; general and abundant in Ohio.

Control.—Prevent seed production by spudding or hoe-cutting the first-year rosettes below the crown during fall or early spring and by mowing the flower-stalks before bloom. Badly infested land should be put under cultivation.

Notes.—This weed is avoided by grazing animals because of its offensive odor. The easily detached fruits are widely disseminated on the coats of grazing animals. They are especially troublesome in wool.

151. ***Lithospermum arvense** L. Corn Gromwell. Redroot.— Erect, slender, generally branched stem; alternate, lance-shaped, linear or linear-oblong, blunt or slightly pointed, entire, bright green leaves, narrowed at the base, sessile or the lowest short-petioled; and small, white flowers, sessile or nearly so in the upper axils, forming leafy-bracted clusters in which the flowers are crowded at first but become distant during the long blooming period as new flowers are formed at the top of the elongating stem. The funnel-shaped, 5-lobed corolla-tube scarcely equals the 5 narrowly lance-shaped calyx-segments. The fruit is composed of 4 wrinkled, pitted, brown nutlets, shorter than the calyx. The entire plant is covered with fine, appressed hairs.

Annual, winter annual, or biennial naturalized from Europe; propagated by hard seeds which retain their vitality for a number of years. Flowering period: spring and summer.— In grainfields (especially wheat), meadows, roadsides, and waste places; general and abundant in Ohio, particularly in the northern and northwestern counties.

Control.—Prevent seeding by hand-pulling, hoe-cutting, or close mowing before bloom. In badly infested wheatfields burning over the stubble, surface cultivation after harvest to induce germination, followed by plowing, harrowing, or discing to destroy the seedlings, and a cultivated crop the next spring are advisable. It is sometimes advisable to plow up a badly fouled wheat crop in the spring and to put the land under clean cultivation, omitting winter grains from the rotation until this weed is brought under control.

152. **Echium vulgare** L. Blue-weed. Viper's-bugloss.— Erect, rather slender, simple or branched stem; alternate, oblong to linear lance-shaped, entire leaves, sessile or the lowest ones narrowed into petioles; and numerous, rather large, bright blue to violet-purple (pink in the bud) flowers in compound, one-sided, leafy-bracted spikes curving at the tips. The calyx has 5 narrow segments much shorter than the corolla; the irregular, tubular-funnel-form corolla is expanded into 5 unequal, spreading lobes. The fruit is composed of 4 small, ovoid, angled, wrinkled nutlets. The entire plant is covered with long, coarse, bristly hairs. This plant has only a rosette of lance-shaped or oblong leaves the first season.

Biennial introduced from Europe; propagated by seeds. Flowering period: summer and early fall.—Along railways, roadsides, in waste places, sometimes in meadows, and pastures; reported from several counties of Ohio.

Control.—Prevent seed production. Spudding or hoe-cutting below the crown during fall or spring, close mowing of the flower-stalks, and fall plowing, followed by clean cultivation the next season, are satisfactory.

Note.—The fruits are troublesome in wool, and the prickly hairs are painful to the touch when mature.

VERBENACEAE. Vervain Family

153. **Verbena urticaefolia** L. White Vervain. Nettle-leaf Vervain.— Slender, 4-sided, erect stem with ascending branches; opposite, long ovate to broadly lance-shaped, pointed, coarsely toothed leaves, usually rounded at the base and borne on short, grooved petioles; and very small, inconspicuous, white or blue flowers scattered on numerous, long, slender, branched, ascending spikes. The tubular calyx is 5-toothed; the funnel-shaped, 5-lobed corolla is somewhat irregular in shape. The small, dry fruit is composed of 4 linear-oblong nutlets. The entire plant is more or less rough-hairy and is frequently made unsightly by the growth of a powdery mildew on the leaves.

Native perennial, propagated by seeds. Flowering period: summer and early fall.— Chiefly a weed of meadows, pastures, roadsides, and waste ground; especially troublesome in rather moist soils; general and abundant in Ohio.

Control.—Practice grubbing or hand-pulling before bloom when the ground is soft, clean cultivation of a hoed crop, and mowing of pastures and waste ground several times during the season.

154. **Verbena hastata** L. Blue Vervain.— Erect, 4-sided stem with ascending branches toward the top; opposite, oblong lance-shaped, pointed, double-toothed leaves, narrowed at the base or the lower ones with basal lobes, all borne on short grooved petioles; and small, blue flowers generally close together or overlapping on numerous, slender, branched, ascending spikes The flowers and fruits are similar to those of the preceding species. The entire plant is more or less rough-hairy and is sometimes covered with a powdery mildew.

Native perennial, propagated by seeds. Flowering period: summer and early fall.—An unsightly weed in pastures, meadows, and waste ground, especially in moist fertile soils; general and abundant in Ohio.

Control.—Same methods as for white vervain.

155. **Verbena stricta** Vent. Hoary Vervain.— Stout, erect, leafy, obtusely 4-angled stem, simple or branched toward the top; opposite, ovate to oblong, double-toothed, prominently veined leaves, narrowed at the base, sessile or the lower ones on very short, winged petioles; and conspicuous, purplish-blue or pink flowers in dense, stout spikes, solitary or several together. The entire plant is densely covered with fine, white hairs.

Native perennial, propagated by seeds. Flowering period: summer and early fall.—Chiefly a weed in pastures and waste ground; flourishes in dry, sandy or gravelly soils; somewhat less common than the preceding vervains.

Control.—Same methods as for white vervain.

LAMIACEAE. MINT FAMILY. LABIATES

156. **Marrubium vulgare** L. Common Hoarhound.— Stout, square, erect stem, simple or with ascending branches; opposite, stout-petioled, broadly ovate or rounded, scallop-toothed leaves; and small, white flowers in dense, whorled, axillary clusters. The tubular calyx has 5-10 awl-shaped teeth curved outward; the tubular corolla is 2-lipped, the upper one flat and notched, the lower 3-lobed and spreading. The fruit is composed of 4 smooth, ovoid nutlets. This bitterly aromatic plant is densely covered with whitish hairs, especially on the under side of the leaves.

Perennial naturalized from Europe; propagated by seeds. Flowering period: summer and early fall.—Chiefly a weed of pastures, roadsides, and waste places; general distribution in Ohio.

Control.—Repeated close mowing, hoe-cutting, or hand-pulling before bloom are recommended, as well as clean cultivation of a hoed crop.

Note.—The spiny, recurved points of the calyx-lobes are often caught in the wool of sheep and the seeds disseminated in this way.

157. **Mentha spicata** L. Spearmint.— Smooth, square, erect, branched stem; opposite, sessile or very short-petioled, lance-shaped, pointed, sharply and unequally toothed leaves, narrowed at the base, often hairy on the veins beneath; and small, sessile, whorled, pale purple flowers, subtended by conspicuous, lance-shaped bracts forming narrow, pointed, generally interrupted, terminal spikes. The bell-shaped calyx has 5 nearly equal teeth almost as long as the 2-lipped corolla-tube. The fruit is composed of 4 smooth, ovoid nutlets. Both this species and the following one have a pleasant, aromatic odor.

Perennial naturalized from Europe; propagated by seeds and by shallow rootstocks commonly called runners. Flowering period: summer and early fall.—In moist fields (especially pastures), along roadsides, and in waste ground; general distribution in Ohio.

Control.—Same methods as for peppermint.

158. **Mentha piperita** L. Peppermint.— Smooth, often purplish, square, generally erect, branched stem; opposite, short-petioled, lance-shaped or oblong, pointed, sharply toothed leaves, rounded or narrowed at the base, smooth on both sides or slightly hairy on the veins beneath; and small, rather showy, whorled, purple flowers, subtended by lance-shaped bracts, forming thick, blunt, sometimes interrupted, terminal spikes. The hairy calyx-teeth are about ½ as long as the 2-lipped corolla-tube. The fruit is similar to that of the preceding species.

Perennial naturalized from Europe; propagated by seeds and by creeping rootstocks that are commonly known as runners. Flowering period: summer and early fall.—New plants grow from pieces of the rootstocks broken off and carried to uninfested areas during plowing or cultivation. In fields (especially pastures), waste ground, and along streams; most abundant in moist soils; general distribution in Ohio.

Control.—Grubbing before bloom will prevent seeding and destroy the rootstocks. Practice frequent hoe-cutting or close mowing to starve out the rootstocks; this method may be supplemented by salting.

159. **Lycopus virginicus** L. Virginia Water-hoarhound. Virginia Bugleweed.— Usually somewhat hairy, slender, obtusely 4-sided, erect, simple or branched stem; opposite, ovate to ovate lance-shaped, pointed, sharply and coarsely toothed, smooth, often purplish leaves wedge-shaped at the base, the lower ones petioled, the upper sessile; and small, sessile, white or pale purple flowers in dense axillary clusters. The calyx has 4-5 nearly equal, long ovate

teeth; the funnel-shaped to cylindrical corolla is longer than the calyx and has 4 nearly equal, spreading lobes. The fruit is composed of 4 small, 3-angled nutlets, longer than the calyx. This plant does not have a strongly aromatic odor.

Native perennial, propagated by seeds and by long slender runners. Flowering period: summer and early fall.—In wet pastures or meadows, as well as along streams and ditches; rather general distribution in Ohio.

Control.—Prevent seeding by grubbing or hand-pulling before bloom, or starve out the underground parts by frequent, close mowing.

160. **Lycopus americanus** Muhl. Cutleaf Water-hoarhound. Cutleaf Bugleweed.— Stiff, erect, obtusely 4-angled, often reddish, simple or branched stem; opposite, petioled, lance-shaped to ovate lance-shaped, long-pointed, pinnatifid or deeply cut, often purplish leaves; and small, sessile, white or pale purple flowers in dense, axillary clusters. The calyx has 4-5 stiff, triangular teeth with awl-shaped tips; the corolla is only slightly longer than the calyx. The fruit is similar to that of the preceding species but much shorter than the calyx. The stem and leaves are smooth or lightly covered with short hairs. This plant does not have a strongly aromatic odor.

Native perennial, propagated by seeds and by suckers. Flowering period: summer and fall.—In wet pastures and along streams; general distribution in Ohio.

Control.—Same methods as for Virginia water-hoarhound.

161. **Hedeoma pulegioides** (L.) Pers. American Pennyroyal.— Soft-hairy, low, slender, square, erect stem with numerous, ascending branches; small, opposite, short-petioled, oblong-ovate, sparingly toothed, smooth or lightly hairy leaves, narrowed at the base; and small, short-stalked, bluish-purple flowers in rather loose, axillary clusters. The hairy, 2-lipped calyx has 3 triangular, upper teeth and 2 awl-shaped, lower ones; the upper lip of the corolla is merely notched, but the lower one is 3-lobed. The fruit is composed of 4 small, smooth, ovoid nutlets. This plant has a strongly aromatic odor.

Native annual, propagated by seeds. Flowering period: summer and early fall.—In old pastures, thin meadows, and open woods; flourishes in dry, upland soils; general and abundant in Ohio.

Control.—Mow before bloom. Clean cultivation of a hoed crop, coupled with the application of manure or fertilizers to promote a good growth of crop plants and thereby crowd out the weed, is advisable.

162. **Nepeta cataria** L. Catnip. Catmint.— Rather stout, square, erect stem with numerous, ascending branches; opposite, petioled, ovate to oblong, pointed, coarsely scallop-toothed leaves, heart-shaped at the base; and whorled, dark-spotted, pale purple or white flowers subtended by awl-shaped bracts forming stout, blunt, terminal spikes. The downy calyx has 5 awl-shaped teeth; the corolla is 2-lipped and the middle lobe of the lower lip is scalloped. The fruit is composed of 4 ovoid, slightly flattened, brown nutlets. This plant is densely covered with fine, white hairs and has a strongly aromatic odor.

Perennial naturalized from Europe; propagated by seeds. Flowering period: summer and fall.—A weed around farm buildings, along fences, and roadsides, as well as in waste ground; general and abundant in Ohio.

Control.—The following methods are advisable: grubbing, deep hoe-cutting, or hand-pulling before bloom; close, repeated mowing to starve out the underground parts of the plant; and clean cultivation of a hoed crop.

163. ***Glecoma hederacea** L. (*Nepeta hederacea* (L.) Trev.) Ground-ivy. Gill-over-the-ground.— Hairy, square, slender, creeping, leafy stem with numerous, ascending branches; opposite, long- and slender-petioled, rounded or kidney-shaped, scallop-toothed, hairy leaves; and rather large, short-stalked, pale purple flowers in loose, axillary clusters. The hairy calyx has 5 pointed teeth; the corolla is more than twice as long as the calyx, and the upper lip is 2-lobed while the lower one is 3-lobed. The fruit is composed of 4 small, brown, ovoid nutlets. This plant has a strongly pungent odor.

Perennial naturalized from Europe; propagated by seeds and by slender, creeping root-stocks. Flowering period: spring and summer.—In lawns, fields, roadsides, and waste ground; most abundant in moist, shaded places.

Control.—Ground-ivy is especially troublesome in lawns because its creeping habit of growth crowds out grasses and makes eradication by digging both inefficient and destructive of the turf. The chemical method of eradication summarized below has been found very successful by Welton at the Ohio Station.[3] A solution of sodium chlorate is made by dis-

[3]Further details are given in Ohio Agr. Exp. Station Bimonthly Bulletin for November-December 1929 under title of Sodium Chlorate as a Lawn Weed Killer.

solving 1 to 2 ounces in each gallon of water. One gallon is sufficient to cover 100 square feet when applied with a pressure sprayer; somewhat more is necessary when applied with a sprinkling can. The foliage should be thoroughly wetted. A fall or winter application is preferable because discoloration of the grass is thereby avoided. When applied as directed, this strength of solution does not injure the grass. However, the eradication of a heavy stand of ground-ivy often leaves bare spots in the turf and such areas may be fertilized and reseeded during March, when the ground is honeycombed.

Cultural methods are satisfactory for tillable land.

164. **Leonurus cardiaca** L. Common Motherwort.— Rather stout, square, erect stem with ascending branches; thin, opposite, slender-petioled leaves, the lower ones large, rounded, palmately 3-5-lobed or cleft into pointed, sharp-toothed divisions; the upper leaves narrower, fewer-lobed or near the top merely lance-shaped and toothed; and purple, pink, or white flowers in dense, whorled, axillary clusters. The hairy calyx has 5 rigid, spiny-tipped teeth; the 2-lipped corolla has a concave upper lip. The fruit is composed of 4 small, brown, 3-angled nutlets covered at the apex by short, brownish hairs. The stem and leaves are lightly covered with short hairs.

Perennial naturalized from Europe; propagated by seeds. Flowering period: summer and early fall.—In vacant lots, gardens, along roadsides, around dwellings, and in waste ground; general and abundant in Ohio.

Control.—Grubbing or deep hoe-cutting before bloom, supplemented by salting to discourage sprouting, and plowing and frequent cultivation of a tilled crop are recommended control methods.

165. **Lamium amplexicaule** L. Common Henbit. Dead-nettle.— Slender, square, ascending or decumbent stem with branches from the base or lower axils; opposite, rounded, coarsely scallop-toothed leaves, heart-shaped at the base, the lower ones slender-petioled, the upper sessile or slightly clasping; and small, red or purplish flowers in small, whorled, axillary and terminal clusters. The hairy calyx has 5 awl-shaped teeth; the slender corolla has a somewhat hairy, erect, concave, upper lip and a lower lip with a large, spotted, middle lobe, as well as 2 small, lateral ones. The fruit is composed of 4 3-angled, white-dotted nutlets. The stem and leaves are sparingly short-hairy.

Winter annual or biennial introduced from Europe; propagated by seeds which remain viable for several years. Flowering period: spring and fall.—In lawns, gardens, cultivated fields, and waste ground; rather general distribution in Ohio.

Control.—Practice hoeing or hand-pulling before the bloom periods of early spring and autumn. Clean cultivation of a crop is effective, but the area must be plowed and harrowed early in the spring and should receive surface cultivation in the fall after the crop has been removed. A smother crop such as clover or alfalfa is effective.

Notes.—A crop of seeds is produced in late spring and another crop in autumn. The autumn seedlings produce an early crop of seeds the following year. This weed frequently dies down during the summer.

PLANTAGINACEAE. Plantain Family

166. ***Plantago rugelii** Dcne. Rugel's Plantain.— A basal rosette composed of large, firm, smooth or short-hairy, entire or coarsely toothed, longitudinally ribbed, yellow-green leaves, varying in shape from broadly elliptic or long ovate to broadly ovate with a heart-shaped base, all borne on long, grooved petioles, purplish toward the base; and small, green or purplish flowers, rather densely clustered above but scattered below, forming long, slender, taper-pointed spikes at the summit of the leafless stalks. The 4 oblong sepals are ridged on the back; the corolla is 4-lobed. The fruit is an oblong capsule opening much below the middle and containing 4-10 minutely roughened, oval, oblong, or rhomboidal seeds.

Native perennial, propagated by seeds. Flowering period: summer and fall.—A troublesome weed in lawns, pastures, meadows, open woods, along roadsides, and in waste ground; thrives best in moist, fertile soils; general and abundant in Ohio.

Control.—This weed succumbs to thorough cultivation. Badly infested meadows should be given over to a tilled crop for one or two seasons.

The following methods can be used for scattered plants in lawns: spudding well below the crown; gasoline or kerosene injected into the crown by means of an oiling can; a small amount of concentrated sulphuric acid applied to the crown with an ice pick, iron rod, or pointed stick; a teaspoonful of salt applied to the crown is fairly satisfactory.

Experiments by Welton at the Ohio Station have shown that the perennial plantains with broad leaves can be eradicated with sulphate of ammonia applied at the rate of 10 to 15 pounds on 1000 square feet of lawn. Applications should always be made when the foliage

Fig. 22

a. **Plantago rugelii** (Rugel's Plantain)
b. **Glecoma hederacea** (Ground-ivy)
c. **Veronica arvensis** (Field Speedwell)
d. **Lithospermum arvense** (Corn Gromwell)

is wet so that the sulphate will stick well. Satisfactory eradication is possible in one season provided from four to five applications are made at monthly intervals, beginning when the plantain first comes into bloom. The fertilizer should always be evenly distributed. Bare spots may be reseeded in the fall or spring after the treatment.

Notes.—The seeds are mucilaginous when wet and are thus easily disseminated on the feet of animals. They are also distributed by birds. Buried seeds retain their vitality for several years.

167. ***Plantago major** L. Common Plantain. Broad Plantain.— Similar in general appearance to the preceding species but the leaves are thicker, pale gray-green, usually smaller, and the petioles are not purplish toward the base. The flowers are densely clustered in long, blunt spikes. The sepals are shorter and broader than in the preceding species. The fruit is an ovoid capsule opening at about the middle and containing 5-16 wavy-ridged seeds.

Native perennial, propagated by seeds. Flowering period: late spring to early fall.—In lawns, pastures, meadows, roadsides, and waste ground; especially troublesome in moist, fertile soils; rather general distribution in Ohio.

Control.—Same methods as for Rugel's plantain.

168. ***Plantago lanceolata** L. Ribgrass Plantain. Buckhorn. English Plantain.— A basal rosette composed of firm, soft-hairy, entire, longitudinally ribbed, oblong lance-shaped leaves narrowed to margined petioles with tufts of brownish hairs at the base; and small flowers in very dense, blunt, ovoid to cylindric spikes at the summit of the long, slender, grooved, leafless stalks. The 4 ovate sepals have narrow, green midribs and thin, colorless margins. The fruit is a blunt, oblong capsule opening at about the middle and containing 2 shining, light brown, boat-shaped seeds.

Perennial or biennial naturalized from Europe; propagated by seeds. Flowering period: late spring to the end of the season.—A common weed in lawns, pastures, meadows, poorly cultivated fields, along roadsides, and in waste ground; it grows well in light, sandy, unfertile soils; general and abundant in Ohio.

Control.—This plantain can also be kept down by clean culture of a crop such as corn. Such treatment through one or two seasons is always advisable for heavily infested meadows. Improvement of soil fertility is essential. Sheep will graze on this weed to some extent.

Spudding, as well as the application of gasoline, concentrated sulphuric acid, or salt, is satisfactory for lawns when the number of plants is not too large. As with other lawn weeds, proper fertilization to encourage a healthy stand of grasses is helpful.

Notes.—This weed produces a larger number of seeds than the preceding plantains and they remain viable in the soil for several years. The seeds become mucilaginous when wet and are thus readily disseminated. A heavy stand of this weed tends to crowd out grasses.

169. **Plantago aristata** Mx. Large-bracted Plantain. Bracted Plantain.— A basal rosette composed of rather thick, entire, longitudinally ribbed, linear, dark green leaves narrowed to short, margined petioles; and small flowers, each subtended by long, linear, ascending bracts, forming very dense, blunt, cylindrical spikes at the summit of stout stalks. The 4 oblong, blunt sepals have thin, colorless margins. The fruit is an oblong to ovoid capsule opening at about the middle and containing 2 dull, brown, boat-shaped seeds, each with a shallow, transverse groove on the outer face. The entire plant is covered with fine, soft hairs.

Native winter annual or biennial from the West; propagated by seeds. Flowering period: spring to the end of the season.—In fields, meadows, pastures, and waste ground; it thrives in dry, unfertile soils; rather general distribution in Ohio.

Control.—Prevent seed production. Hoeing or hand-pulling for scattered plants and spudding for occasional plants in lawns are advisable. Early spring preparation of the seedbed followed by clean cultivation of a hoed crop, supplemented by surface cultivation after harvest, are satisfactory for infested fields. Pastures and waste ground should be mowed several times during the season. The use of green manures and fertilizers is helpful since bracted plantain is most prevalent in poor soils that do not support a dense, crowding stand of crop plants.

Notes.—The plants are not readily recognized before bloom. This weed produces a large number of seeds that are mucilaginous when wet. They retain their vitality for several years in the soil.

AMMIACEAE. Carrot Family. Umbellifers

170. ***Daucus carota** L. Wild Carrot. Queen-Anne's-lace.— Grooved, erect, branched stem; alternate leaves with the lower blades 2-3 times pinnately compounded into lance-

Fig. 23

a. **Plantago lanceolata** (Ribgrass Plantain)
b. **Plantago major** (Common Plantain)
c. **Pastinaca sativa** (Wild Parsnip)
d. **Conium maculatum** (Poison-Hemlock)

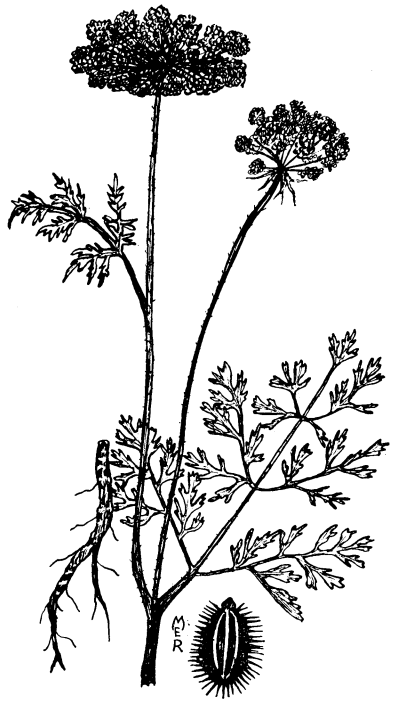

Fig. 24
Daucus carota (Wild carrot)

shaped, toothed or lobed leaf-segments, the upper blades less divided, all borne on petioles with a dilated, partly sheathing base; and numerous, small, white or creamy flowers in large, flat, compound, stalked, terminal clusters subtended by finely cut, leafy bracts, the clusters becoming concave as the longer outer stalks bend inward at maturity. The oval fruit is composed of 2 boat-shaped halves joined along the flat side; each half has several rows of weak, often hooked, whitish spines along the ribs on the outer side. The entire plant is more or less bristly-hairy.

Biennial naturalized from Europe; propagated by seeds. Flowering period: summer and early fall.—Chiefly a weed of thin, run-down meadows and pastures, as well as fencerows, roadsides, and waste ground; general and abundant in Ohio.

Control.—Prevent seed production. Hoe-cutting or spudding the autumn rosettes below the crown, as well as close cutting or hand-pulling the flower-stalks during early bloom, are satisfactory methods for small areas. This weed yields readily to clean cultivation.

Wild carrot can be gradually brought under control in meadows, pastures, roadsides, and waste areas by a first mowing, during early bloom, just below the lowest flower clusters, followed by a second low mowing when the next crop of flowers appears. Wild carrot tends to stool after cutting and unless the first mowing is high the second crop of flowers will be formed too low to be clipped by the later mowing.

Badly infested meadows should be put under cultivation.

Notes.—This weed is the uncultivated form of the garden carrot.

The fruits are light enough to be distributed quite readily by winds, especially over snow. The numerous, frail spines serve to attach them to each other and to passing animals. The seeds will remain viable in the soil for several years and are a frequent impurity in clover and alfalfa seeds.

This plant is usually avoided by grazing animals because of its acrid sap.

171. ***Pastinaca sativa** L. Wild Parsnip.— Smooth, prominently grooved, hollow, rather stout, erect, branched stem; alternate, pinnately compound, smooth or somewhat downy-hairy basal and lower leaves on flattened petioles with a dilated, partly sheathing base, the leaf-segments large, sessile, ovate or oval, blunt, doubly toothed or cleft, often lobed; much smaller, clasping, upper leaves; and very small, numerous, yellow flowers in large, compound, stalked, terminal clusters not subtended by bracts. The fruit is composed of 2 smooth, broadly oval, much flattened halves with narrow, corky margins; each half has 4 brown oil-tubes and 3 narrow, corky ribs on the outer side. This plant has a strong odor when crushed.

Biennial naturalized from Europe; propagated by seeds. Flowering period: summer months.—Chiefly a weed of roadsides and other waste ground, but sometimes in meadows and pastures; most frequent in moist soils; general and abundant in Ohio.

Control.—The following methods are recommended: spudding or hoe-cutting the autumn plants, hand-pulling when the ground is soft, or close cutting during early bloom. Plowing and clean cultivation are satisfactory.

Notes.—The corky fruits are readily distributed by wind and water. This weed is the uncultivated form of the garden parsnip.

172. **Heracleum lanatum** Mx. Cow-parsnip.— Woolly-hairy, prominently ridged, very stout, erect stem; alternate, ternately compound leaves on stout, much inflated, hollow

petioles with a clasping base, the 3 leaf-segments large, stalked, broadly ovate, sharply toothed and lobed, hairy especially on the veins beneath; and numerous, fairly large, white or pinkish flowers in very large, compound, stalked, terminal clusters with only the secondary stalks subtended by linear bracts. The fruit is similar in general appearance to that of the preceding species but is larger and hairy. This plant has a strong odor, especially when crushed.

Native perennial, propagated by seeds. Flowering period: summer months.—A weed of stream banks and moist soils of meadows, pastures, and waste ground; rather general distribution in Ohio.

Control.—Digging or deep spudding of the fleshy root or mowing previous to bloom is advisable.

173. **Angelica atropurpurea** L. Purple-stemmed Angelica. Great Angelica.— Smooth, ridged, purplish, hollow, tall, stout, erect, branched stem; very large, alternate, biternately compound leaves on stout, hollow, broadly dilated, often sheathing petioles; smooth, pinnate, ovate or oval, pointed, sharply toothed or cut leaf-segments; and numerous, small, white flowers in large, compound, stalked, terminal clusters, either without bracts or with only small ones. The fruit is composed of 2 small, oval or oblong, flattened halves with broad, corky margins; each half has 3 prominent, corky ribs and numerous, indistinct oil-tubes on the outer side.

Native perennial, propagated by seeds. Flowering period: summer months.—A coarse unsightly weed of river bottoms and wet pastures; rather general distribution in Ohio.

Control.—Same methods as for cow-parsnip.

174. ****Conium maculatum** L. Poison-hemlock.—Smooth, ridged, spotted, hollow, erect, much branched stem; alternate, smooth, pinnately decompound leaves, the lower ones on petioles with a dilated, sheathing base, the upper sessile or nearly so; ovate or lance-shaped leaf-segments, again pinnately dissected into toothed or incised segments with the veins terminating in their colorless bristle-tips; and numerous, small, white flowers in fairly large, open, compound, terminal clusters subtended by ovate, long-pointed bracts. The fruit is composed of 2 smooth, slightly flattened, light brown, boat-shaped halves joined along the flat side; each half has several, prominent, wavy ribs, as well as a layer of oil-secreting tissue on the outer side. This plant has a strong odor, especially when crushed.

Biennial introduced from Europe; propagated by seeds. Flowering period: summer months.—Chiefly a plant of waste ground; reported from several counties.

Control.—This poisonous plant should be dug up and burned wherever found.

Notes.—Rather small amounts of this plant are poisonous to both man and animals. Poison-hemlock was probably the plant employed by the ancient Greeks for the execution of criminals. The principal poisonous compound found in the plant is an alkaloid called coniin. It is volatile; hence dried plants are less dangerous. All parts of the plant are poisonous; the leaves are especially so up to flowering time, and the green fruits contain a large amount of the poisonous alkaloid. This plant has a disagreeable odor but it may be eaten by stock early in the season when succulent, especially if other forage is scarce.

175. ****Sium cicutaefolium** Schrank. Water-parsnip.—Smooth, ridged, hollow, stout, erect, branched stem; alternate, smooth, pinnately compound leaves, the lower ones on ribbed, wide-margined petioles with a somewhat sheathing base, the upper nearly sessile; leaflets sessile, linear or lance-shaped, long-pointed, sharply and finely toothed, or the basal ones sometimes finely dissected, especially if submerged; and numerous, small, white flowers in open, compound, terminal clusters subtended by linear bracts. The oval fruit is composed of 2 smooth, slightly flattened, brownish, boat-shaped halves joined along the flat side; each half has several, broad, corky ribs and 1-3 oil-tubes on the outer side.

Native perennial, propagated by seeds. Flowering period: summer and fall.—Limited to swamps and low marshy ground; general distribution in Ohio.

Control.—Digging or hand-pulling, especially in situations accessible to grazing animals, is recommended.

Notes.—This plant is reported as poisonous by several writers. The poisonous properties have not been thoroughly investigated.

176. ****Cicuta maculata** L. Spotted Water-hemlock. Water-hemlock. Spotted Cowbane.— Fleshy, ovoid or oblong, tuberous roots clustered below the swollen, transversely-chambered stem-base; smooth, hollow, stout, erect, branched stem marked with purple lines, especially pronounced at the junction with the branches; alternate, smooth, pinnately decompound leaves on petioles with a dilated, sheathing base; leaf-segments lance-

shaped or oblong lance-shaped, coarsely and sharply toothed with veins ending in the notches; and numerous, small, white flowers in open, compound, terminal clusters with the bracted secondary stalks of unequal length, thereby giving the clusters an uneven appearance. The broadly oval fruit is composed of 2 smooth, boat-shaped halves joined along the flat side; each half has 5 broad, corky ribs and 4 oil-tubes on the outer side as well as 2 oil-tubes on the inner side.

Cicuta bulbifera L., bulb-bearing water-hemlock, differs from the above species by its slender, linear leaf-segments and small bulblets developed in the leaf axils. It has the same poisonous properties but is found chiefly in the northern half of Ohio.

Native biennial, propagated by seeds. The tuberous roots, according to investigations by Hansen at the Purdue Station, are annual, but a single bud at the base of the stem is biennial, serving to start new growth of both tops and tubers the second season. Flowering period: summer months.—This plant is limited to wet soils of meadows, pastures, swamps, and borders of streams; general distribution in Ohio.

Control.—Grubbing or careful hand-pulling after loosening the cluster of tubers with a spud is recommended. The plants should be collected and burned, and care should be taken not to scatter any of the tubers. The area should be inspected later for sprouts. Livestock should be kept out until eradication is complete.

Notes.—Spotted water-hemlock is a deadly poisonous plant. The poisonous compound is a resin-like substance called cicutoxin. The yellowish, glistening, aromatic drops of liquid that ooze out when a tuber is cut contain this poison. The tuberous roots and swollen base of the stem, even when dried, are the most poisonous parts of the plant. The young spring shoots, especially before they have unfolded, are likewise poisonous. There is some difference of opinion with regard to the mature tops, but they are at least much less toxic than the tubers and young shoots, and stock are not apt to eat them at that stage.

Grazing animals are most likely to graze off the young shoots in the spring when pasture is scarce. Since the plant grows in wet soils, the attached tubers are often pulled out and eaten with the tops. Hogs have been known to root out and devour the tubers. Children have sometimes mistaken the tubers for those of plants with edible, aromatic roots, generally with fatal results.

The general, described symptoms for animals are marked pain and nervousness, muscular twitching followed later by violent convulsions, frothing at the mouth, weak, rapid pulse, labored breathing, and dilated pupils. The poison acts rapidly, and, if fatal, the animal usually dies within several hours. No satisfactory antidote is known.

CAMPANULACEAE. Bellflower Family

177. **Specularia perfoliata** (L.) A. DC. Venus'-looking-glass.— Slender, weak, often prostrate, retrorsely stiff-hairy stem, simple or branched from the base; alternate, wavy-toothed or entire leaves, mostly clasping the stem by a heart-shaped base; and small, sessile, axillary, blue or violet flowers, either solitary or 2-3 together. The wheel-shaped corolla is 5-lobed. The oblong or narrowly top-shaped fruit has 3 cavities and opens about the middle. The entire plant is more or less hairy.

Native annual, propagated by seeds. Flowering period: late spring to early fall.—Chiefly a weed in old meadows, hillside pastures, and woods; prevalent in dry, sterile soils; general distribution in Ohio.

Control.—Control measures suggested are: hoe-cutting or hand-pulling before bloom; clean cultivation of a hoed crop; improvement of soil fertility; repeated mowing of pastures and waste ground.

DIPSACACEAE. Teasel Family

178. ***Dipsacus sylvestris** Huds. Wild Teasel.— Stout, prominently ridged, erect, branched stem; opposite, sessile, oblong or lance-shaped, pointed, entire leaves often united at the base; and small, lilac or pinkish flowers in dense, ovoid to oblong, long-stalked, solitary, terminal or axillary heads subtended by narrow, upwardly curved bracts, frequently longer than the heads. The calyx is 4-lobed; each of the tubular, 4-lobed corollas is subtended by an ovate bract tapered to an awl-shaped, barbed awn, generally longer than the flower. The brown fruit is oblong, ribbed, and square in cross-section. The stem, midribs, flower-stalks, and floral bracts bear numerous short prickles. Only a flat rosette of oblong or lance-shaped, blunt, scallop-toothed leaves with prickles on the midrib beneath is formed during the first year.

Biennial naturalized from Europe; propagated by seeds. Flowering period: summer and fall.—Chiefly a weed of roadsides, fencerows, pastures, and waste ground; general and abundant in Ohio.

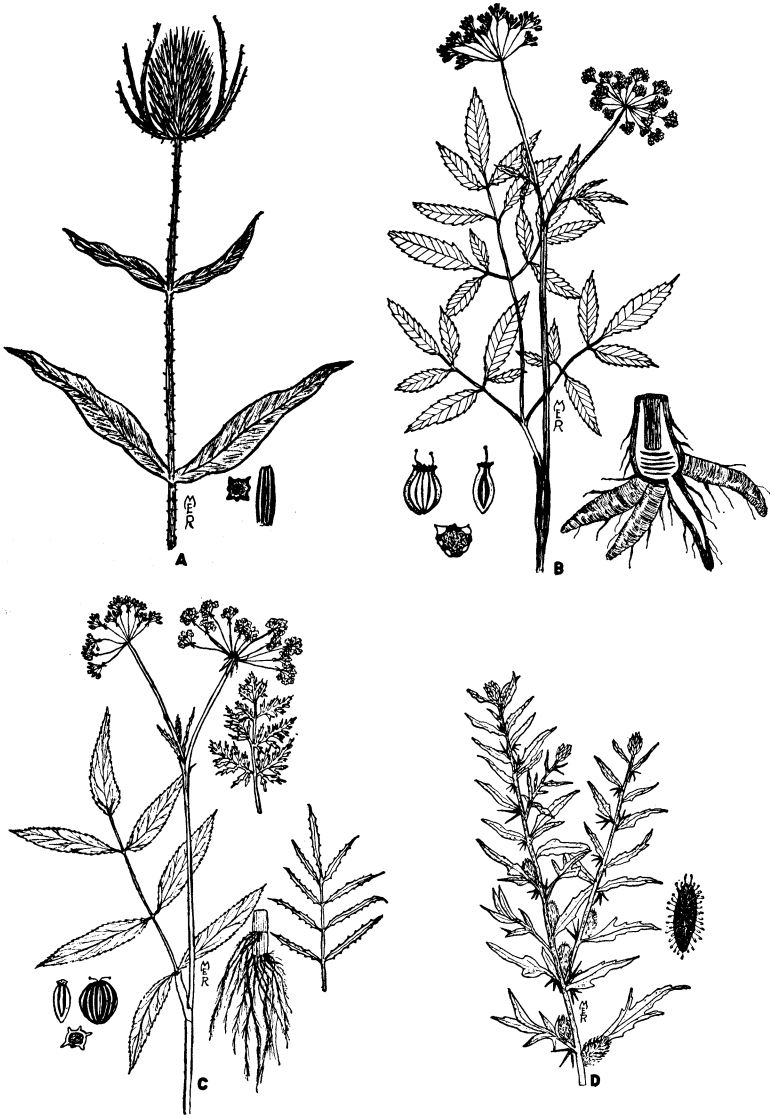

Fig. 25

a. **Dipsacus sylvestris** (Wild Teasel)
b. **Cicuta maculata** (Spotted Water-hemlock)
c. **Sium cicutaefolium** (Water-parsnip)
d. **Xanthium spinosum** (Spiny Cocklebur)

Control.—Measures suggested are: deep hoe-cutting or grubbing in autumn or spring to destroy the first-year rosettes; cutting or hand-pulling the flower-stalks before bloom. Large areas should be mowed.

AMBROSIACEAE. RAGWEED FAMILY

179. ***Xanthium pennsylvanicum** Wallr. (*Xanthium canadense* Mill.) Pennsylvania Cocklebur.— Angled, spreading, branched stem, roughish toward the top; alternate, long-petioled, broadly ovate, blunt or pointed, sharply toothed or sometimes 3-5-lobed, somewhat rough, glandular leaves; small, greenish, staminate flowers in globose clusters at the ends of the branches; and broadly oblong, spiny, bristly-hairy, closed carpellate involucres below in axillary clusters. The involucre bears a flower in each of its 2 cavities; it later develops into a brown, bristly-hairy bur covered with long, rigid, awl-shaped, hooked prickles and tipped with a pair of stout, incurved, hooked beaks. Each bur contains 2 oblong, flattened, dark fruits.

Fig. 26
Xanthium pennsylvanicum
(Pennsylvania Cocklebur)
After Beal.

Native annual, propagated by seeds. Flowering period: summer and fall.—In farmyards, pastures, grain crops, and cornfields, as well as along roadsides, fencerows, banks of streams, and ponds; most abundant in moist, fertile soils; general distribution in Ohio.

Control.—Prevent seeding by hand methods or by clean cultivation of a crop, such as corn. Early plowing, repeated harrowing to destroy spring seedlings, clean cultivation as late as possible, and hand methods after the crop has been laid by are necessary to make this method effective.

Spring weeding and fall plowing or discing will prevent seeding in infested grainfields.

Smother crops, such as buckwheat, soybeans, clover, or alfalfa, are effective against the cockleburs.

Mowing, or mowing and burning in case seeds have formed, is necessary to prevent reinfestation from plants on waste ground.

Notes.—The spiny burs are readily disseminated on clothing and the coats of animals. Wool may be seriously damaged by them. Only one of the pair of seeds in each bur normally germinates the first season. Buried seeds may remain viable for several years.

Feeding experiments have shown that cocklebur seedlings are poisonous to livestock when grazed during the period of development of the cotyledons but before the true leaves have developed to any extent. The cotyledons are green and succulent at this stage. Identification is difficult due to their grass-like appearance. The plant apparently loses its toxicity as soon as the true leaves are developed. Foliage of mature cockleburs is bitter and generally avoided so that, although the burs contain poisonous seeds, little trouble is experienced from that source. Swine, cattle, and sheep may be poisoned, but young pigs are most susceptible. Areas flooded during the spring are most dangerous, as the seedlings may appear in large numbers when the water recedes.

180. ***Xanthium americanum** Walt. (*Xanthium glabratum* (DC.) Britt.) American Cocklebur.— Rough, erect, usually branched stem; alternate, slender-petioled, broadly ovate, toothed, more or less 3-5-lobed, roughish, 3-ribbed leaves, heart-shaped at the base; and flowers similar to those of the preceding species. The oblong burs are covered with smooth or slightly hairy, hooked prickles and tipped with a pair of nearly straight, often 2-toothed beaks. The fruits are similar to those of the preceding species.

Native annual, propagated by seeds. Flowering period: summer and fall.—A weed in fields and waste ground; most abundant in moist soils; less common in Ohio than the Pennsylvania cocklebur.

Control.—Same methods as for Pennsylvania cocklebur.

181. *__Xanthium spinosum__ L. Spiny Cocklebur.— Ascending or erect, much branched stem covered with whitish hairs; alternate, short-petioled, lance-shaped, pointed leaves narrowed at the base, the lower ones lobed, the upper entire, the under side as well as the veins above covered with white-woolly hairs, each leaf with a yellow, 3-pronged spine in the axil; small, greenish, staminate flowers in globose clusters forming short, terminal spikes; and few or solitary, narrowly oblong, hairy, spiny, carpellate involucres in the axils below. Each involucre develops into a light brown bur covered with numerous, smooth, hooked prickles and tipped with a pair of short, straight beaks. Each bur contains 2 dark brown, flattened fruits.

Annual introduced from tropical America. Flowering period: summer and fall.—Chiefly a weed of waste ground but may invade both cultivated crops and grassland; much less common in Ohio than the preceding cocklebur.

Control.—Same methods as for Pennsylvania cocklebur.

Note.—The small, spiny burs are readily carried in the coats of animals.

182. *__Ambrosia trifida__ L. Giant Ragweed. Tall Ragweed. Horseweed.— Ridged, stout, tall, erect, branched stem; opposite, 3-nerved leaves, commonly palmately divided into 3-5 large, broad, pointed, coarsely toothed lobes but sometimes undivided, ovate or lance-shaped, merely toothed or even entire especially toward the top, all borne on stout, margined petioles; small, greenish, staminate flowers in small, short-stalked, saucer-shaped involucres forming long, cylindrical, terminal and axillary clusters; and clusters of top-shaped, 1-flowered, carpellate involucres enclosed by bracts in the upper axils. Each involucre is tipped with a stout, cone-shaped beak when mature and is armed with 5-7 smaller tubercles that terminate each of the lateral ribs. Each involucre contains a single, dark fruit. The entire plant is more or less rough and covered with short, stiff hairs.

Native annual, propagated by seeds. Flowering period: summer and fall.—A weed of cultivated ground, grainfields after harvest, stream borders, roadsides, and fencerows; most prevalent in moist, fertile soils; general distribution in Ohio.

Control.—Same methods as for Roman ragweed.

Notes.—The tall, woody stems of this plant make it one of our most unsightly annual weeds. The seeds are widely distributed during spring floods. A heavy growth is very injurious in grain crops, and the seeds are removed with difficulty from the cleaning screens.

183. __Ambrosia psilostachya__ DC. Western Ragweed.— Ridged, erect, freely branched stem; opposite or alternate, petioled leaves, 1-2 times pinnately divided into thick, narrow, pointed lobes; small, greenish, staminate flowers in bell-shaped involucres forming long, cylindrical, terminal and axillary clusters; and usually solitary, obovoid, 1-flowered, carpellate involucres in the axils below. Each involucre is tipped with a short beak and either armed with 4 short tubercles or unarmed. The entire plant is more or less rough and covered with short, stiff, appressed or spreading, whitish hairs.

Native perennial introduced from the West; propagated both by seeds and creeping roots. Flowering period: summer and fall.—It is a weed of prairies and plains; is apt to invade any crop; as yet only reported locally from a few Ohio counties.

Control.—Prevent seed production and remove or starve out the underground parts. Practice clean cultivation of a hoed crop or plowing after harvest to expose the roots, supplemented by a tilled crop the next season. Small patches may be killed out by applications of strong salt brine.

184. *__Ambrosia elatior__ L. (*Ambrosia artemisiifolia* L.) Roman Ragweed.— Slightly ridged, erect, generally much branched stem; opposite or alternate, petioled leaves, 2-3 times pinnately divided into thin, narrow, blunt or pointed lobes, pale green beneath; small, greenish, staminate flowers in cup-shaped involucres forming numerous, rather stout, cylindrical, terminal and axillary clusters; and clustered or solitary, top-shaped, 1-flowered, carpellate involucres enclosed by bracts in the axils below. Each involucre is tipped with a short beak and armed with 4-6 small, pointed teeth that terminate each of the lateral ribs. The entire plant is somewhat rough and more or less covered with spreading or appressed, whitish hairs.

Native annual, propagated by seeds. Flowering period: summer and fall.—A troublesome weed of cultivated ground, grainfields after harvest, meadows, pastures, roadsides, and waste places; grows well in rather dry soils; general and abundant in Ohio.

Control.—Suitable methods are: clean, frequent cultivation of tilled crops continued as late as possible and supplemented by hand methods; clipping of badly infested grainfields during late summer after removal of the crop or shallow plowing and surface cultivation;

early mowing of infested meadows; mowing of infested pastures, roadsides, and waste areas often enough to prevent seeding; and top dressing of thin pastures to encourage a heavy stand of grasses, thereby crowding out the weed to some extent.

Notes.—A large number of seeds is produced by each plant and buried seeds remain viable in the soil for several years. The bitter foliage is usually avoided but sometimes is eaten by dairy cows when forage is scarce. An objectionable odor and flavor is thereby imparted to dairy products. The inhaled pollen of the several species of ragweeds is responsible for numerous cases of hay fever each year.

HELIANTHACEAE. SUNFLOWER FAMILY

185. **Galinsoga parviflora** Cav. Galinsoga.— Slender, erect, much branched stem; opposite, ovate, pointed, 3-nerved, toothed or wavy-margined leaves, the lower slender-petioled, the upper short-petioled to sessile; and small, slender-stalked, terminal and axillary heads composed of 4-5 short, 3-toothed, white rays and numerous, yellow disk-flowers. Ray-flowers carpellate, fertile; disk-flowers bisporangiate; involucre hemispheric, with 2 rows of small, blunt, ovate bracts; achenes small, flat or angled, wedge-shaped, hairy, with a crown of oblong, irregularly toothed, whitish scales. The entire plant is more or less covered with appressed, whitish hairs.

Annual introduced from tropical America; propagated by seeds of which it produces a large number. Flowering period: summer to late fall.—A weed of cultivated and waste ground; frequently troublesome in gardens; becoming rather widely distributed in Ohio.

Control.—Prevent seed production by hoeing, hand-pulling, frequent mowing, or clean cultivation continued until late in the season.

186. **Rudbeckia hirta** L. Black-eyed-Susan. Brown-eyed-Susan.— Rather stout, erect, simple or branched, often tufted stems; alternate, rather thick, sparingly short-toothed or entire leaves, the basal ones 3-nerved, oblong to spatula-shaped, blunt, narrowed to slightly margined petioles; the stem leaves varying from oblong to lance-shaped, pointed, narrowed to a sessile base; and solitary or few, long-stalked, terminal, showy heads composed of yellow or orange ray-flowers and numerous, brownish-purple disk-flowers. Ray-flowers neutral; disk-flowers bisporangiate, seed-producing; receptacle ovoid to globose, chaffy; bracts linear, spreading, in 2 or more rows, shorter than the rays; achenes dark, 4-angled, lightly ridged, without a crown of bristles. The entire plant is somewhat rough and densely covered with bristly whitish hairs.

Native biennial, propagated by seeds. Flowering period: summer and fall.—Chiefly in old meadows and along roadsides but occasionally in pastures and cultivated ground; it grows well in dry soils; general and abundant in Ohio.

Control.—Hand methods are satisfactory for scattered plants. Infested meadows should be mowed early; heavily infested meadows should be put under cultivation.

187. ***Helianthus doronicoides** Lam. Oblong-leaf Sunflower.— Stout, erect, tall stem, branched above; rather large, thick, ascending, ovate, ovate-oblong, or oblong lance-shaped, pointed, 3-nerved, short-toothed leaves, opposite below, alternate above, all narrowed to a sessile, often slightly clasping base; and rather numerous, stalked, terminal heads composed of 12-20 yellow rays and numerous, yellow disk-flowers. Ray-flowers neutral; disk-flowers bisporangiate, seed-producing; involucre hemispheric, with lance-shaped, long-pointed, hairy bracts; achenes oblong, flattened, smooth, dark brown, lightly ridged, crowned with 2 awl-shaped, deciduous awns. The entire plant is more or less rough and bristly-hairy.

Native perennial, propagated by seeds and by slender rootstocks. Flowering period: late summer and fall.—In fields, waste ground, and along roadsides; thrives in dry soils; rather general distribution in Ohio, but more abundant in the central and western counties.

Control.—Hand methods, salting, frequent mowing, and clean cultivation are satisfactory.

188. ***Helianthus tuberosus** L. Jerusalem Artichoke.— Rough-hairy, stout, tall, erect stem, branched toward the top; large, firm, ovate-oblong, long-pointed, 3-nerved, coarsely toothed leaves, the lower ones opposite, the upper alternate, all rough above as well as finely hairy or rough beneath, narrowed at the base to rather long, margined, hairy petioles; and rather numerous, terminal, showy heads composed of 12-20 yellow rays and numerous, yellow disk-flowers. Involucre hemispheric, with lance-shaped, long-pointed, hairy bracts; achenes oblong, angled, dark brown, ridged, somewhat hairy, crowned with 2 awl-shaped awns.

Native perennial, propagated by seeds and by tuber-bearing rootstocks. Flowering period: late summer and fall.—In meadows, waste ground, and along roadsides; it grows best in moist alluvial soils; general distribution in Ohio.

Fig. 27

a. **Helianthus doronicoides** (Oblong-leaf Sunflower)
b. **Ambrosia trifida** (Giant Ragweed)
c. **Ambrosia elatior** (Roman Ragweed)
d. **Galinsoga parviflora** (Galinsoga)

Control.—Digging, repeated hoe-cutting, salting, frequent mowing, and clean cultivation are effective methods. Hogs will destroy the tubers.

Note.—The tubers are edible.

189. ***Helianthus annuus** L. Common Sunflower.— Rough, stout, tall, erect stem, branched toward the top; mostly alternate, stout-petioled, broadly ovate, pointed, 3-nerved, toothed, dull green leaves, rough on both sides as well as often hairy beneath; and large, showy, stalked, terminal heads composed of large, yellow rays and numerous, usually purplish-brown disk-flowers. Involucre depressed, with ovate or ovate lance-shaped, sharp-pointed, bristly-hairy bracts; achenes large, oblong, ridged, grayish-brown, smooth or appressed-hairy, crowned with several awl-shaped bracts.

Native annual introduced from the West; propagated by seeds. Flowering period: summer and fall.—In meadows, fencerows, vacant lots, waste ground, and along roadsides; rather general distribution in Ohio.

Control.—Prevent seed production by hand-pulling, hoeing, close mowing, or clean cultivation. Alfalfa is useful as a smother crop.

190. **Bidens connata** Muhl. Swamp Bur-marigold. Stick-tights. Swamp Beggar-ticks.— Smooth, purplish, tall, erect, usually branched stem; mostly opposite, smooth, thin, sharply and coarsely toothed, long-pointed leaves, usually lance-shaped but the lower ones rarely 3-lobed, all except the uppermost narrowed to slender petioles; and numerous, rather large, slender-stalked, terminal and axillary heads composed of orange disk-flowers and sometimes a few, golden-yellow rays. Ray-flowers, when present, neutral; disk-flowers bisporangiate, seed-producing; involucre bell-shaped to hemispheric, with 2 rows of bracts, the outer larger than the inner ones; achenes dark brown, wedge-shaped, angled, hairy, tipped with 2-4 downwardly barbed awns.

Native annual, propagated by seeds. Flowering period: late summer and fall.—It is chiefly a weed in moist soils; rather general distribution in Ohio.

Control.—Prevent seed production and improve drainage. Hand methods and clean cultivation are satisfactory. Waste land should be mowed closely previous to bloom and often enough thereafter to prevent seeding by late plants.

Notes.—The barbed awns on the fruits are readily attached to clothing and the coats of animals. They are often troublesome in wool and may be widely distributed in this way.

191. ***Bidens frondosa** L. Black Beggar-ticks. Stick-tights.— Smooth, often purplish, erect stem with spreading branches; smooth, opposite, slender-petioled leaves, pinnately 3-5-divided into oblong lance-shaped, pointed, sharply toothed segments, the terminal one long-stalked, all narrowed at the base; and usually numerous, slender-stalked, terminal and axillary heads composed of orange disk-flowers and sometimes a few, small, yellow rays. Involucre bell-shaped to hemispheric, with narrow, leafy, hairy-margined, outer bracts that mostly exceed the colorless-margined inner ones; achenes dark, wedge-shaped, flat, hairy, tipped with 2 diverging, downwardly barbed awns.

Native annual, propagated by seeds. Flowering period: summer and fall.—In cultivated ground, pastures, roadsides, and waste places; most troublesome in moist soils.

Control.—Same methods as for swamp bur-marigold.

192. ***Bidens vulgata** Greene. Tall Beggar-ticks.— Smooth or lightly hairy, tall, erect, much branched stem; smooth, opposite, slender-petioled leaves pinnately 3-5-divided into oblong lance-shaped, pointed, sharply-toothed, prominently-veined segments, all short-stalked as well as narrowed at the base; and rather large, stout-stalked heads, composed of numerous, yellow disk-flowers and mostly small, pale yellow rays. Outer involucral bracts unequal, hairy-margined, usually longer than the disk and exceeding the ovate to narrowly triangular, inner ones; achenes dark brown, wedge-shaped, flat, nearly smooth, tipped with 2 downwardly barbed awns.

Native annual, propagated by seeds. Flowering period: late summer and fall.—In moist soils of fields and waste ground; general distribution in Ohio.

Control.—Same methods as for swamp bur-marigold.

193. ***Bidens bipinnata** L. Spanish-needles.— Smooth, 4-sided, slender, erect, much branched stem; thin, mostly opposite, slender-petioled leaves, 1-3-pinnately dissected into lance-shaped, toothed, hairy-margined segments; and usually numerous, long-stalked, terminal and axillary heads composed of rather few, yellow disk-flowers and few, small, yellow, dark-veined rays. Involucre narrowly bell-shaped, with linear, ascending, outer bracts shorter than the broader, pointed, erect, inner ones; achenes brown, slender, spindle-shaped, 4-angled, tipped with 2-4 diverging, downwardly barbed, yellowish awns.

Fig. 28

a. **Helianthus tuberosus** (Jerusalem Artichoke)
b. **Bidens frondosa** (Black Beggar-ticks)
c. **Helianthus annuus** (Common Sunflower)

Native annual, propagated by seeds. Flowering period: summer and fall.—In cultivated ground, pastures, along roadsides, and in waste places; thrives in both moist and moderately dry soils; rather general distribution in Ohio.

Control.—Same methods as for swamp bur-marigold.

194. **Bidens trichosperma** (Mx.) Britt. Tall Tickseed.— Smooth, slightly 4-sided, rather tall, erect, much branched stem; smooth, opposite leaves, the lower ones pinnately divided into 5-7, narrowly lance-shaped, pointed, sharply and coarsely toothed, short-stalked or sessile segments; the upper leaves nearly or quite sessile, less divided or entire; and numerous, large, long-stalked, loosely clustered, terminal and axillary heads composed of yellow disk-flowers and large, blunt, golden-yellow rays. Involucre hemispheric, with linear to spatula-shaped outer bracts that about equal the broader inner ones; achenes dark brown, narrowly wedge-shaped, somewhat stiff-hairy, tipped with 2 short, 3-angled, upwardly barbed awns.

Native annual, propagated by seeds. Flowering period: late summer and fall.—Chiefly a weed in wet soils of meadows and swampy areas but sometimes grows in dry soils of roadsides and waste ground; general distribution in Ohio.

Control.—Same methods as for swamp bur-marigold. Mowing during late summer and fall is especially important.

195. **Boebera papposa** (Vent.) Rydb. (*Dysodia papposa* (Vent.) Hitchc.) Fetid Marigold.— Leafy stem with numerous, erect or diffuse branches; small, opposite, short-petioled to sessile leaves, pinnately or bipinnately dissected into narrow, toothed segments; and numerous, small, short-stalked heads composed of yellow disk-flowers and a few, short, yellow rays. Ray-flowers carpellate; disk-flowers bisporangiate; involucre cup-like with 1 row of oblong, often purplish, inner bracts, as well as a few, narrow, shorter, outer ones; achenes dark, wedge-shaped, covered with stiff, ascending, brownish hairs, and crowned with stiff, brownish bristles. This plant is strong-scented, gland-dotted, and usually lightly covered with short hairs.

Native annual introduced from the West; propagated by seeds. Flowering period: summer and fall.—In fields, roadsides, and other waste ground; introduced into several Ohio counties probably in baled hay and impure seed.

Control.—Methods recommended are: mowing, hoe-cutting, or hand-pulling before bloom, and clean cultivation of a hoed crop.

196. **Antennaria plantaginifolia** (L.) Rich. Plantain-leaf Everlasting.— A basal rosette of petioled, obovate or spatula-shaped, blunt or pointed, 3-5-ribbed leaves, dull green and somewhat woolly-hairy above, silvery and densely woolly-hairy beneath; alternate, sessile, small, erect, lance-shaped, woolly-hairy stem leaves; and short, erect stalks bearing a compact, terminal cluster of small heads composed of tubular, greenish-white flowers. Involucre of the staminate heads composed of blunt, oblong bracts with broad, petaloid, whitish tips; involucre of the carpellate heads composed of narrower, pointed, greenish-white bracts; staminate heads borne on low plants; carpellate heads borne on taller plants. The small, oblong, brown achenes have a crown of long, whitish bristles.

Native perennial, propagated by seeds and by stolons. Flowering period: spring and summer.—Chiefly a weed in rather dry, unfertile soils of open or partly shaded upland pastures; general distribution in Ohio.

Control.—Small patches may be hoed out and the area reseeded. Fertilization to encourage a thrifty stand of grasses is helpful for permanent pastures overrun with this weed. Close mowing will prevent seeding to some extent. Clean cultivation is recommended where practicable.

197. **Solidago canadensis** L. Canada Goldenrod. Tall Goldenrod.— Rather slender, usually tall, erect, simple stem, hairy toward the top; numerous, thin, alternate, mostly sessile, oblong lance-shaped to linear, long-pointed, 3-nerved leaves, finely toothed or entire, narrowed to the base, finely hairy on the veins beneath; and numerous, small heads composed of yellow rays and tubular disk-flowers, arranged more or less on one side of the spreading, recurved, hairy branches of the broadly pyramidal, terminal inflorescence. Ray-flowers mostly carpellate and short; disk-flowers bisporangiate; involucre oblong, with several rows of narrow, pointed bracts; achenes small, slightly hairy, crowned with fine hair-like bristles.

Native perennial, propagated by seeds and by rootstocks. Flowering period: late summer and fall.—Chiefly a weed of roadsides, fencerows, wood borders, and waste places; it is seldom troublesome in cultivated ground; general and abundant in Ohio.

Fig. 29

a. **Bidens vulgata** (Tall Beggar-ticks)
b. **Aster ericoides** (White Heath Aster)
c. **Antennaria plantaginifolia** (Plantain-leaf Everlasting)
d. **Bidens bipinnata** (Spanish-needles)

Control.—Prevent seed production and remove or starve out the underground parts by grubbing, close mowing throughout the season, or fall plowing to expose the rootstocks, followed by a cultivated crop the next season.

198. ***Aster ericoides** L. (Incl. *Aster ericoides pilosus* (Willd.) Porter.) White Heath Aster. Steelweed.— Erect, usually bushy-branched stem, varying from smooth to thickly hairy; alternate, firm, smooth or short-hairy leaves, the basal ones spatula-shaped, often sparingly toothed, narrowed to margined petioles; the stem leaves numerous, small, entire, linear, lance-shaped or often awl-shaped on the branches; and many, small heads composed of 15-25 white to pinkish rays and tubular, yellow to purplish disk-flowers, arranged more or less on the upper sides of the spreading branches. Ray-flowers mostly carpellate; disk-flowers bisporangiate; involucre somewhat bell-shaped, with several rows of lance-shaped, green-tipped bracts; achenes small, hairy, flattened, with a crown of hair-like bristles.

Native perennial, propagated by seeds. Flowering period: late summer to the end of the season.—A weed in dry, unfertile soils of roadsides, fencerows, meadows, pastures, and waste ground; it is not aggressive in cultivated land; general distribution in Ohio; especially abundant in the counties bordering the Ohio River.

Control.—Prevent seeding and remove or starve out the underground parts. Pastures, roadsides, and waste land should be mowed several times during the season. Infested meadows are best put under cultivation. Sheep will destroy the tops of young plants.

Note.—The woody stems are objectionable in forage.

199. **Erigeron philadelphicus** L. Philadelphia Fleabane.— Mostly hairy, slender, erect, often tufted stems, generally branched above; basal, as well as alternate, hairy leaves, the basal and lower ones spatula-shaped to obovate, blunt, toothed, narrowed to margined petioles; the upper leaves narrower, mostly pointed, toothed or entire, clasping by a heart-shaped base, commonly twisted into the profile position; and a number of showy, stout-stalked heads composed of 100-150 fringe-like, purple rays, and numerous, greenish-yellow disk-flowers, forming an open terminal cluster. Ray-flowers carpellate; disk-flowers bisporangiate; involucre somewhat hemispheric, with several rows of overlapping, linear, colorless-margined bracts; achenes small, flattened, with a crown of hair-like bristles.

Native perennial, propagated by seeds, stolons, and offsets from the crown. Flowering period: late spring to early fall.—In meadows, thickets, open woods, and waste ground; most troublesome in moist alluvial soils; general distribution in Ohio.

Control.—Prevent seeding and remove or starve out the underground parts by hand methods, by frequent mowing throughout the season, or by clean cultivation.

200. ***Erigeron annuus** (L.) Pers. White-top Fleabane.— Slightly ridged, stiff, erect stem with branches above; basal, as well as alternate, thin leaves, the basal and lower ones ovate or ovate lance-shaped, usually coarsely toothed, narrowed to margined petioles; the upper leaves sessile or short-petioled, oblong to linear lance-shaped, pointed, all but the upper ones sharply toothed along the sides; and rather numerous, small, short-stalked heads composed of considerably less than 100 white to purplish rays and numerous, yellowish disk-flowers, clustered at the ends of stem and branches. Involucre hemispheric, with several rows of narrow bracts; achenes small, slightly hairy, crowned with an inner row of deciduous bristles and an outer row of short, slender scales. The entire plant is sparingly covered with spreading hairs.

Native winter annual or annual, propagated by seeds. The bulk of the seed crop is produced by the winter annual plants that bloom during May and June. A small part of the yearly crop is produced by annual plants and weak winter annuals that bloom irregularly during the remainder of the season. Flowering period: late spring to the end of the season.—Chiefly a weed of meadows, pastures, roadsides, and waste ground, but sometimes troublesome in grain crops; general distribution in Ohio.

Control.—Prevent seed production. Hoe-cutting the rosettes during fall or early spring, as well as hand-pulling before bloom, is a satisfactory method for scattered plants in meadows and grainfields.

Clipping during early May will prevent the majority of white-top plants from seeding in meadows. The weed is usually enough taller than the crop at that time so that the cutter-bar can be adjusted to miss the crop but remove the tops of the weeds.

Early mowing of infested meadows is advisable in case spring clipping has been neglected.

Spring plowing followed by a spring grain, such as oats, or a cultivated crop is the best treatment for meadows so heavily infested with white-top that the ensuing hay crop would be

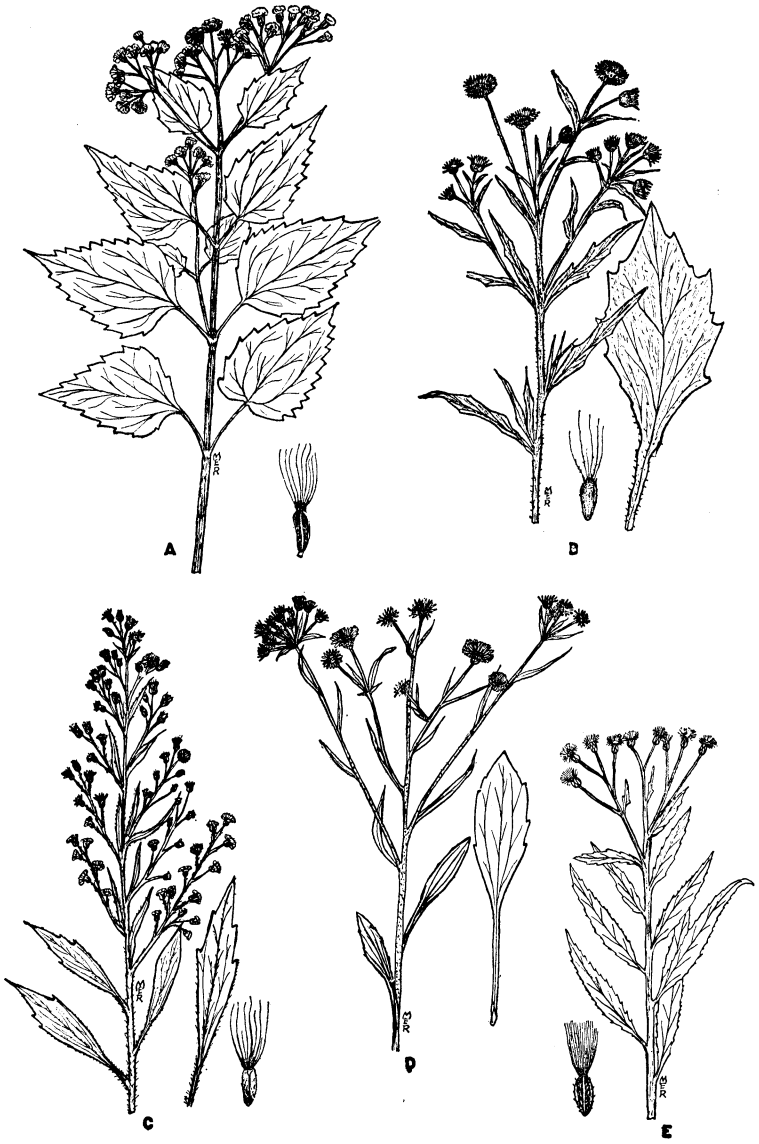

Fig. 30

a. **Eupatorium urticaefolium** (White Snake-root)
b. **Erigeron annuus** (White-top Fleabane)
c. **Leptilon canadense** (Common Horseweed)
d. **Erigeron ramosus** (Daisy Fleabane)
e. **Vernonia altissima** (Tall Ironweed)

of little value. Meadows should be inspected during the fall or early spring for the prevalence of white-top rosettes. Plowing and thorough preparation of the seedbed are necessary; merely disking for oats does not satisfactorily destroy the rosettes.

Sheep are of considerable aid in cleaning up timothy meadows, fencerows, and waste ground; they readily eat the young tender shoots and first-year rosettes.

The following treatment is satisfactory for pastures, fencerows, roadsides, and waste places: a first mowing, in June before bloom, with the cutter-bar set to pass just beneath the lowest flowers; a second mowing during late summer with the cutter-bar set low to catch flowers formed on new side shoots.

Notes.—This annual weed is an especial problem in meadows because the seeds ripen before the crop is cut. White-top fleabane is invariably most abundant during the season following a wet fall. The light seeds are found largely on the surface of the soil and only with high soil moisture are they able to germinate and establish a root system. The seeds will remain viable in dry soils for several years and with the advent of a wet fall the weeds appear in a meadow or grain crop on land that was considered to be comparatively free from white-top.

The rosettes of this weed have been reported as a palatable source of early spring greens.

201. ***Erigeron ramosus** (Walt.) B. S. P. Daisy Fleabane. White-top.— Rather slender stem with branches toward the top, usually shorter than the preceding species; basal, as well as alternate, leaves, the basal and lowest ones oblong or spatula-shaped, toothed, narrowed to slightly margined petioles; the stem leaves sessile, oblong lance-shaped to linear lance-shaped, nearly or quite entire; and small heads of ray- and disk-flowers similar to those of the preceding species. Ray-flowers occasionally minute or wanting; involucre with smooth, linear, pointed bracts; achenes similar to those of the preceding species. The entire plant is more or less covered with appressed hairs.

Native annual or winter annual, propagated by seeds. Flowering period: late spring to late fall.—Chiefly a weed in meadows, pastures, roadsides, and waste places; general distribution in Ohio.

Control.—Same methods as for white-top fleabane.

202. ***Leptilon canadense** (L.) Britt. (*Erigeron canadensis* L.) Common Horseweed. Canada Fleabane.— Bristly-hairy or nearly smooth, finely grooved, tall, erect, wand-like, generally simple stem; alternate, crowded leaves, more or less hairy, especially along the margins, the basal and lower ones spatula-shaped, narrowed into margined petioles, often sparingly and coarsely toothed; the upper leaves lance-shaped or linear, mostly entire; and numerous, very small, short-stalked heads composed of numerous, short, white rays and tubular disk-flowers, arranged in a large, branched, terminal cluster, as well as smaller axillary ones. Ray-flowers carpellate, shorter than the bisporangiate disk-flowers; involucre narrowly bell-shaped, with 1-2 rows of linear, pointed, nearly smooth bracts; achenes small, flattened, crowned with a row of yellowish-brown bristles.

Native annual or winter annual, propagated by seeds. Flowering period: summer to midfall.—Chiefly a weed of meadows, pastures, roadsides, and waste ground; general distribution in Ohio.

Control.—Prevent seed production by hand methods, close mowing, or clean cultivation. The tough stem and rather short roots permit of easy pulling, especially after rains. Infested meadows should be mowed early. Late fall plowing to destroy autumn rosettes, followed by a cultivated crop the next season, is advisable for badly infested meadows. Areas mowed in bloom should be burned over to destroy the seeds.

Notes.—Each plant produces a large number of small seeds that are widely distributed by winds. The bitter, resinous sap makes the weed objectionable to grazing animals. The plant often causes marked irritation of the skin when handled to any extent.

203. **Eupatorium purpureum** L. Purple Joe-Pye-weed. Tall Boneset.— Smooth or sparingly hairy, often purplish, sometimes finely grooved, tall, erect stem, simple or branched at the top; thin, petioled, ovate to narrowly lance-shaped, long-pointed, toothed, gland-dotted leaves, slightly hairy on the veins beneath, arranged in whorls of 3 to 6 at each node, or the upper ones opposite; and numerous, small heads of tube-shaped, bisporangiate, pink or purple flowers, forming long, branched, rounded or pyramidal, terminal and axillary clusters. Involucre cylindrical, with several rows of overlapping, oblong, purplish bracts, the outer shorter; achenes dark, slender, 5-angled, with a funnel-shaped crown of fine, usually rough bristles.

Native perennial, propagated by seeds. Flowering period: late summer and fall.—Chiefly a weed in moist soils of pastures, borders of woods, thickets, roadsides, and banks of streams; general distribution in Ohio.

Control.—Prevent seed production and remove or starve out the roots. Digging, repeated deep cutting, or salting is satisfactory for small patches; mowing or clean cultivation will take care of large areas.

204. **Eupatorium perfoliatum** L. Common Boneset. Thoroughwort.— Hairy, stout, generally tall, erect stem with branches at the top; large, mostly opposite, lance-shaped, long-pointed, finely scallop-toothed, gland-dotted leaves with their wide bases united around the stem, rough or hairy beneath; and numerous, small heads of tube-shaped, bisporangiate, white or rarely blue flowers, forming rather compact, branched, flat-topped, terminal and axillary clusters. Involucre bell-shaped, with 2 or more rows of hairy, lance-shaped bracts, the outer shorter; achenes similar to those of the preceding species.

Native perennial, propagated by seeds. Flowering period: midsummer to midfall.— Chiefly a weed in moist or wet soils of pastures, roadsides, and meadows, as well as borders of streams and swamps; general distribution in Ohio.

Control.—Good drainage is important, but otherwise the methods of control are the same as for purple Joe-Pye-weed.

205. ****Eupatorium urticaefolium** Reich. (*Eupatorium ageratoides* L. f.) White Snakeroot.— Slender, rather tall, erect, branched stem; mostly opposite, slender-petioled, ovate, long-pointed, coarsely and sharply toothed or scallop-toothed, 3-nerved, thin leaves, truncate, heart-shaped, or narrowed at the base, somewhat lustrous beneath; and numerous, small heads of tube-shaped, bisporangiate, bright white flowers, forming large, rather loose, branched, terminal and axillary clusters. Involucre narrowly bell-shaped, with 1-2 rows of nearly equal, linear bracts; achenes black, slender, 5-angled, with a crown of fine, white bristles. The stem and leaves are either smooth or lightly beset with long, soft hairs and are often somewhat viscid.

Native perennial, propagated by seeds. Flowering period: midsummer to the end of the season.—Chiefly in moist, fertile soils of open woods, thickets, wooded pastures, and stream banks, but sometimes on hillsides and recently cleared but unbroken land; general distribution in Ohio.

Control.—Prevent seed production and destroy the perennial roots. A careful inspection of woodlot pastures during summer and fall is good insurance against losses of livestock. Grubbing or hand-pulling is satisfactory for small areas. The shallow, fibrous roots are readily removed, especially when the ground is soft. Mowing is less satisfactory because the plants sprout. White snake-root often persists in cleared land until it is put under cultivation and again seeded down.

Sodium chlorate at a dilution of one pound to a gallon is effective.

Notes.—Both definite feeding experiments and the experience of stockmen have demonstrated that white snake-root is poisonous to domestic animals. Poisoning is most apt to occur when pasture is short during a period of drouth or when an infested, wooded pasture is overgrazed. There is some indication that the toxicity of the plants may vary in different localities, as well as probably from year to year in the same locality. The action of the poison is cumulative. The toxic compound of white snake-root has recently been separated and named tremetol.

The early symptoms of white snake-root poisoning in animals are listlessness and a stiff, unsteady gait. Except in horses, the later stages are marked by fits of trembling, especially after exertion. This symptom has given the name of trembles to the disease in animals. In fatal cases, the animal falls and death follows after a period of exhaustion.

Severe or fatal cases of milk-sickness in man have been traced to the use of milk from cows that had fed on the plant.

206. ***Vernonia altissima** Nutt. (*Vernonia maxima* Small.) Tall Ironweed.— Smooth, somewhat woody, tall, erect stem, branched near the top; alternate, sessile, oblong lance-shaped, long-pointed, finely toothed, thin, dark green leaves, tapering to the base, smooth or slightly hairy beneath; and numerous, small, mostly stalked heads of tube-shaped, bisporangiate, mostly purple flowers, forming a large, rather loose, widely branched, terminal cluster. Involucre bell- to top-shaped with several rows of overlapping, appressed, blunt to bristle-tipped, hairy-margined, purplish bracts; achenes oblong, flat-topped, 8-10-ribbed, with a crown composed of an inner row of long, rough, purplish bristles, as well as an outer row of short, scale-like ones.

Native perennial, propagated by seeds. Flowering period: summer and early fall.— Chiefly a weed in moist, fertile soils of permanent pastures, roadsides, and undisturbed waste ground; general and abundant in Ohio.

Control.—Prevent seed production and remove or starve out the perennial roots. Hand methods or salting is satisfactory for scattered plants and small patches. Repeated close mowing throughout the season will keep this weed under control in pastures and waste ground. Practice clean cultivation of a tilled crop where practicable.

A single application of sodium chlorate has been reported as an effective herbicide under Ohio conditions.

207. ***Anthemis cotula** L. Common Dog-fennel. Mayweed. Fetid Camomile.— Erect, ascending, or spreading, much branched stem, smooth below but often hairy and glandular above; alternate, mostly sessile, smooth or slightly hairy leaves, more or less oblong in outline, but twice or thrice pinnately dissected into linear or thread-like, pointed segments; and fairly numerous, showy, stalked, terminal heads composed of tube-shaped, yellow disk-flowers and 10-18 spreading, mostly 3-toothed, white rays. Ray-flowers neutral; disk-flowers bisporangiate, fertile; receptacle convex; involucre hemispheric, with several rows of overlapping, oblong, blunt, often hairy, colorless-margined bracts; achenes brown, oblong, ribbed, roughened with glandular tubercles, without a crown of bristles. This plant has a strongly fetid odor.

Annual or winter annual naturalized from Europe; propagated by seeds. Flowering period: summer to late fall.—In fields, gardens, farmyards, waste ground, and along roadsides; most troublesome in wet soils, especially where the crop has been killed out; general and abundant in Ohio.

Control.—Prevent seed production by hoeing, mowing, or clean cultivation of a hoed crop. This weed is largely crowded out by a heavy stand of alfalfa or grasses.

Notes.—This weed has an acrid sap. Grazing animals avoid it. The sap is an irritant of the skin and the pollen sometimes causes hay fever, or at least an irritation of the mucous membranes. Buried seeds retain their vitality for a relatively short period.

208. **Anthemis arvensis** L. Field Dog-fennel. Corn Camomile. Field Camomile.— Short, minutely hairy stem with numerous, decumbent, spreading or ascending branches; alternate, sessile, hairy leaves, oblong in outline but once or twice divided into linear or lance-shaped, pointed segments, broader and less divided than in the preceding species; and fairly numerous, showy, stalked, terminal heads composed of tube-shaped, yellow disk-flowers and 10-18 spreading, mostly 2-toothed, white rays. Ray-flowers carpellate, seed-producing; disk-flowers bisporangiate, fertile; involucre with several rows of overlapping, oblong, blunt, hairy, colorless-margined bracts; achenes light brown, somewhat 4-angled, ribbed, with only a minute border of bristles. This plant does not have a fetid odor.

Annual or biennial introduced from Europe; propagated by seeds. Flowering period: spring and summer.—A weed of cultivated ground, roadsides, waste places, and sometimes an invader in meadows and grainfields, especially if the stand is poor. It is neither as abundant nor widely distributed in Ohio as common dog-fennel.

Control.—Prevent seeding by hand-pulling, hoeing, mowing, or clean cultivation.

Note.—This plant lacks the acrid sap that is characteristic of the preceding species.

209. **Achillea millefolium** L. Common Milfoil. Yarrow.— Stiff, erect stem, simple or forked above; alternate, bright green leaves, oblong to lance-shaped in outline but twice or thrice pinnately dissected into narrow, finely toothed segments; the basal leaves, as well as those of the short, sterile shoots, large, mostly petioled; the stem leaves sessile, smaller, less divided; and numerous, small heads of tube-shaped, yellowish disk-flowers as well as 4-6 small, white to pinkish rays, forming dense, branched, nearly flat-topped, terminal clusters. Ray-flowers carpellate, fertile; disk-flowers bisporangiate, seed-producing; involucre somewhat bell-shaped, with several rows of overlapping, oblong, blunt, hairy bracts; achenes oblong, flattened, without a crown of bristles. This plant has a strong odor; it varies from smooth to densely soft-hairy.

Native perennial, propagated by seeds and by horizontal rootstocks. Flowering period: summer to late fall.—Chiefly a weed of pastures, lawns, meadows, roadsides, and waste places. It grows well in dry, stony soils; general and abundant in Ohio.

Control.—Prevent seed production and remove or starve out the rootstocks. Digging or close, frequent mowing throughout the season and clean cultivation are recommended practices. Sheep will graze this plant to some extent.

210. ***Chrysanthemum leucanthemum** L. Oxeye Daisy. White Daisy. White-weed.— Smooth or sparingly short-hairy, slender, erect, often tufted stems, simple or forked near the top; alternate, usually smooth leaves, the basal ones oblong or spatula-shaped, either coarsely scallop-toothed, sharply cut into irregular lobes or pinnately cleft, all narrowed into slender

petioles; the stem leaves narrowly oblong to linear, pinnately cleft, or the uppermost nearly entire, mostly sessile as well as partly clasping; and large, usually solitary, slender-stalked, terminal heads composed of 20-30 spreading, slightly 2-3-toothed, white rays and numerous, tubular, yellow disk-flowers. Ray-flowers carpellate, fertile; disk-flowers bisporangiate, fertile; receptacle flat to hemispheric; involucre somewhat flattened, with several rows of overlapping, oblong lance-shaped, colorless-margined bracts; achenes dark with 10 light, vertical ribs, obovate, round or angled, without a crown of bristles.

Perennial naturalized from Europe; propagated by seeds and to some extent by offsets from short, thick, somewhat woody, shallow rootstocks. Flowering period: summer and fall.—Chiefly a weed of meadows, pastures, roadsides, waste ground, and occasionally in lawns; it grows readily in dry, unfertile soils; general and abundant in Ohio.

Control.—Prevent seed production and destroy the perennial, underground parts. Hand-pulling for scattered plants and repeated hoe-cutting, supplemented by salting, for small patches are advised.

This weed is seldom a serious problem on land that is fertile enough to support a good stand of clover and grasses. Proper fertilization and the application of lime where necessary are an essential part of the control program.

Infested meadows, pastures, and waste ground should be mowed during first bloom. Sheep will graze readily on the basal tufts of leaves, especially when lightly salted. Heavily infested meadows should be plowed shallowly in the fall to expose the underground parts and planted to a tilled crop.

A solution of 8 ounces of sodium chlorate to a gallon, applied at the rate of one gallon to a square rod, is satisfactory for small patches.

Note.—Each plant produces a large number of seeds that are widely disseminated in grass seed or hay.

211. **Artemisia vulgaris** L. Common Mugwort. Wormwood.— Smooth, erect stem with numerous, sometimes hairy branches; alternate leaves, deeply pinnatifid into linear, oblong, or spatula-shaped segments, all but the upper ones again cut and toothed, the lower leaves petioled, the upper sessile, all smooth and dark green above but densely covered with white, woolly hairs beneath; and numerous, small heads of tubular, greenish-yellow flowers, forming spike-like, simple or compound, terminal and axillary clusters. Involucre somewhat bell-shaped, with oblong to broadly lance-shaped, colorless-margined bracts; achenes brown, oblong or narrowed at the base, slightly ridged, without a crown of bristles.

Perennial introduced from Europe; propagated by seeds. Flowering period: summer and fall.—Sometimes a weed of gardens, roadsides, waste ground, banks of streams, or around dwellings; reported as an escape in several counties of Ohio.

Control.—Prevent seed production and remove or starve out the perennial roots. Hand-pulling, digging, or close, frequent mowing for small patches and clean cultivation for large areas are recommended.

212. **Artemisia biennis** Willd. Biennial Wormwood.— Smooth, often tall, erect stem, simple or with short, nearly erect branches; alternate, smooth, dark green leaves, once or twice pinnatifid into linear or oblong, pointed, toothed or cut segments, the lowest leaves petioled, but the upper sessile, less divided or rarely entire; and very small, tubular, greenish-yellow flowers in numerous, clustered heads, forming spike-like, axillary clusters. Involucre hemispheric, with colorless-margined bracts; achenes similar to those of the preceding species.

Native biennial or annual, propagated by seeds. Flowering period: late summer and fall.—Chiefly a weed of roadsides, railroad embankments, vacant lots, and waste ground; grows well in gravelly or rocky soils; reported from a number of Ohio counties.

Control.—Prevent seed production by hand methods during the fall or spring, by close mowing before bloom, or by clean cultivation.

213. **Artemisia annua** L. Annual Wormwood.— Smooth, frequently tall, erect, much branched stem; alternate, smooth leaves, 2-3 times pinnately divided into short, narrow, blunt segments, the lower ones short-petioled, but the upper sessile, much smaller, less divided; and very small, tubular, greenish-yellow flowers in numerous heads borne on short, slender, drooping stalks, forming loose, compound, axillary clusters. Involucre hemispheric, with few, ovate to oblong, smooth, colorless bracts. This plant has very sweet-scented foliage.

Annual introduced from Europe and Asia; propagated by seeds. Flowering period: summer and fall.—Chiefly a weed of roadsides and waste ground; rather general distribution in Ohio.

Control.—Prevent seed production by hand methods, mowing before bloom, or clean cultivation.

214. **Erechtites hieracifolia** (L.) Raf. Fireweed. Pilewort.— Smooth or slightly hairy, finely ridged, succulent, usually tall, erect stem, simple or with ascending branches; alternate, ovate lance-shaped, irregularly cut and toothed, sometimes hairy leaves, the lower ones narrowed to margined petioles, the upper sessile, often with a pair of basal lobes; and small, tubular, whitish flowers in erect, stalked heads forming open, branched, terminal clusters. Marginal flowers carpellate, fertile; central flowers bisporangiate, fertile; involucre cylindrical but swollen at the base, with a single principal row of smooth, linear, green bracts nearly as long as the flowers; achenes narrowly oblong, with a copious crown of soft, white bristles.

Native annual, propagated by seeds. Flowering period: summer and fall.—An ill-smelling weed of thickets, moist open woods, cultivated lowlands, and recently cleared land, especially if it has been burned over; general distribution in Ohio.

Control.—Prevent seed production by hand methods, by close mowing, or by clean cultivation where practicable.

Note.—The fruits are readily distributed by winds

215. ***Arctium minus** Schk. Common Burdock.— Rough-hairy, ridged, stout, tall, erect, branched stem; alternate, broadly ovate, blunt, more or less wavy-margined, strongly-veined leaves, generally heart-shaped at the base, smooth above, but light green and woolly-hairy beneath, all on stout, hollow petioles; and small, tubular, bisporangiate, purple or white flowers in numerous, short-stalked or sessile heads clustered at the ends of the branches or in the upper axils. Involucre subglobose, with numerous rows of smooth or slightly woolly, erect or spreading bracts, the inner ones shorter than the flowers, all tightly overlapping and tipped with hooked spines, forming a prickly bur; achenes dull brown, oblong, flattened, often curved, several-ribbed.

Biennial naturalized from Europe; propagated by seeds. Flowering period: summer and fall; many of the fruits remain on the plant throughout the winter.—In farm yards, pastures, sod orchards, waste ground, and along roadsides; seldom troublesome in cultivated land; thrives best in moist fertile soils; general and abundant in Ohio.

Control.—Methods recommended are: spudding or hoe-cutting the autumn rosettes or second-year flower-stalks below the crown, supplemented by an application of salt or kerosene to prevent sprouting; clean cultivation of a hoed crop; mature plants should be mowed and burned. The common burdock has a long fleshy taproot and only seedlings can be pulled out, even when the ground is soft. The plants sprout readily at the crown when merely cut off at the soil line. Large areas in waste ground should at least be mowed to prevent seeding.

Notes.—The clinging burs are scattered readily on clothing and on the coats of animals. This weed is an especial nuisance in pastures.

216. ***Arctium lappa** L. Great Burdock.— Stouter and taller stem than in the preceding species; larger leaves on solid, deeply furrowed petioles; and larger, often long-stalked heads of tubular, bisporangiate, purple or white flowers in axillary clusters. Involucre subglobose, with straightish, spreading bracts tipped with hooked spines, the inner ones equalling, or exceeding, the flowers; achenes similar to those of the preceding species but larger, and mottled with gray and brown.

Biennial introduced from Europe; propagated by seeds. Flowering period: summer and fall.—Chiefly a weed of roadsides, fencerows, and waste ground; this species of burdock is not so abundant in Ohio as the preceding one.

Control.—Same methods as for the common burdock.

217. ***Cirsium lanceolatum** (L.) Hill. (*Carduus lanceolatus* L.) Spear Thistle. Common Thistle. Bull Thistle.— Woolly-hairy, stout, tall, erect, branched stem, leafy to the heads; basal leaves in a rosette; alternate, sessile stem leaves, all more or less lance-shaped in outline with the blades broad along the midrib, but pinnately divided into triangular to lance-shaped segments tipped with stout, yellow spines, margins and decurrent leaf bases prickly, the surface dark green as well as stiff-hairy above, but densely woolly-hairy beneath; and numerous, fragrant, tubular, bisporangiate, dark purple flowers in large, solitary, terminal heads. Involucre ovoid to globose, with numerous rows of cottony, narrowly lance-shaped bracts tipped with spreading prickles; achenes oblong, slightly flattened, often curved, whitish with brown stripes, crowned with several rows of long, white, plume-like, deciduous bristles united at the base.

Fig. 31

a. **Cirsium lanceolatum** (Spear Thistle)
b. **Arctium minus** (Common Burdock)
c. **Anthemis cotula** (Common Dog-fennel)
d. **Lactuca saligna** (Willow Lettuce)
e. **Chrysanthemum leucanthemum** (Oxeye Daisy)

Biennial introduced from Europe; propagated by seeds. Flowering period: summer and fall.—In pastures, open woodlots, roadsides, and waste ground; rather general distribution in Ohio.

Control.—Spudding or deep hoe-cutting the autumn rosettes or second-year flower-stalks below the crown is advised. This method may be supplemented by salting. Practice clean cultivation of a hoed crop. Pastures and waste ground should be mowed before bloom.

218. **Cirsium muticum** Mx. (*Carduus muticus* (Mx.) Pers.) Swamp Thistle.— Ridged, slender, tall, erect stem with branches above, woolly-hairy when young; petioled basal leaves in a rosette; alternate, sessile, smaller stem leaves, all with the blades narrow along the midrib but deeply pinnately divided into lance-shaped to oblong, toothed or entire segments usually tipped with slender spines, the margins prickly, the surface green on both sides when mature, but woolly-hairy beneath when young; and purple flowers similar to those of the preceding species in large, solitary, terminal heads. Involucre bell-shaped, with numerous rows of ovate or lance-shaped, somewhat viscid, cottony bracts, pointed but without prickles; achenes similar to those of the preceding species but darker in color.

Native biennial, propagated by seeds. Flowering period: summer and fall.—A weed in wet soils of pastures, open woods, and waste land; general distribution in Ohio, but in most cases not an aggressive weed.

Control.—Same methods as for spear thistle.

219. ***Cirsium arvense** (L.) Scop. (*Carduus arvensis* L.) Canada Thistle. Field Thistle.— Ridged, slender, tall, erect, branched stem, smooth or sparsely hairy; sessile or sometimes petioled basal leaves in a rosette; alternate, sessile, slightly clasping, occasionally short-decurrent stem leaves, oblong or lance-shaped in outline, but deeply and irregularly pinnately divided into toothed or lobed segments tipped with stout spines, the margins prickly and wavy, the surface green on both sides when mature, but sometimes woolly-hairy beneath when young; and tubular, purple or sometimes whitish flowers in numerous, small, stalked or sessile heads. Involucre with numerous, appressed bracts, the ovate outer ones unarmed or tipped with weak prickles, the longer, successively narrower, inner ones pointed but without prickles; normal achenes light brown, narrowly ovoid to oblong, slightly flattened, often curved, crowned with several rows of white to tawny, plume-like, deciduous bristles. The ovoid to flask-shaped heads of the carpellate plants have short corollas, long-exserted styles, short undeveloped stamens, and normal achenes; the oblong heads of the staminate plants have long corollas, exserted anthers with abundant pollen, and shriveled achenes crowned with short bristles.

This plant is very variable as to form. The common variety, *integrifolium* Wimm and Grab., has mostly uncut leaves or the lowest ones may be slightly pinnatifid.

Perennial introduced from Europe; propagated by seeds and by extensively creeping, horizontal roots that bud new plants at frequent intervals. The above-ground shoots are annual or biennial, depending on whether they appear early or late in the season. Flowering period: summer months.—A noxious weed of cultivated land, pastures, meadows, and waste places. The best development of roots is attained in a moist, clay soil. This weed is not tolerant of shade; plants in wooded areas are weak and produce few flowers. Canada thistle is a northern plant and, other factors being favorable, it thrives best under temperatures suitable for the growth of the small grains. General distribution in Ohio except in some of the most southern counties; it is most abundant in the northern and central counties.

Control.—Consult the section on methods of control and eradication for certain noxious perennial weeds.

Notes.—Canada thistle produces enough viable seeds, at least in the northern half of Ohio, to be important as a means of propagation. Insects often destroy a considerable number. The seeds remain viable in the soil for several years.

220. **Onopordon acanthium** L. Scotch Thistle.— Woolly-hairy, stout, tall, erect, branched, leafy stem, wing-angled by the spiny, decurrent leaf bases; alternate, sessile, oblong, pointed, lobed and toothed leaves with sharp, yellowish spines along the margins, the surface densely covered with white-woolly hairs; and tubular, purple disk-flowers in large, solitary, terminal heads broader than high. Receptacle flat, honeycombed; involucre globose, with numerous rows of over-lapping bracts, at least the outer ones minutely toothed, as well as tipped with long, stout, yellow spines; achenes oblong to obovate, angled, tipped with several rows of long, brownish bristles united at the base.

Biennial or annual introduced from Europe; propagated by seeds. Flowering period: summer and fall.—A weed of roadsides and waste places, but of limited distribution in Ohio

Control.—Same methods as for spear thistle.

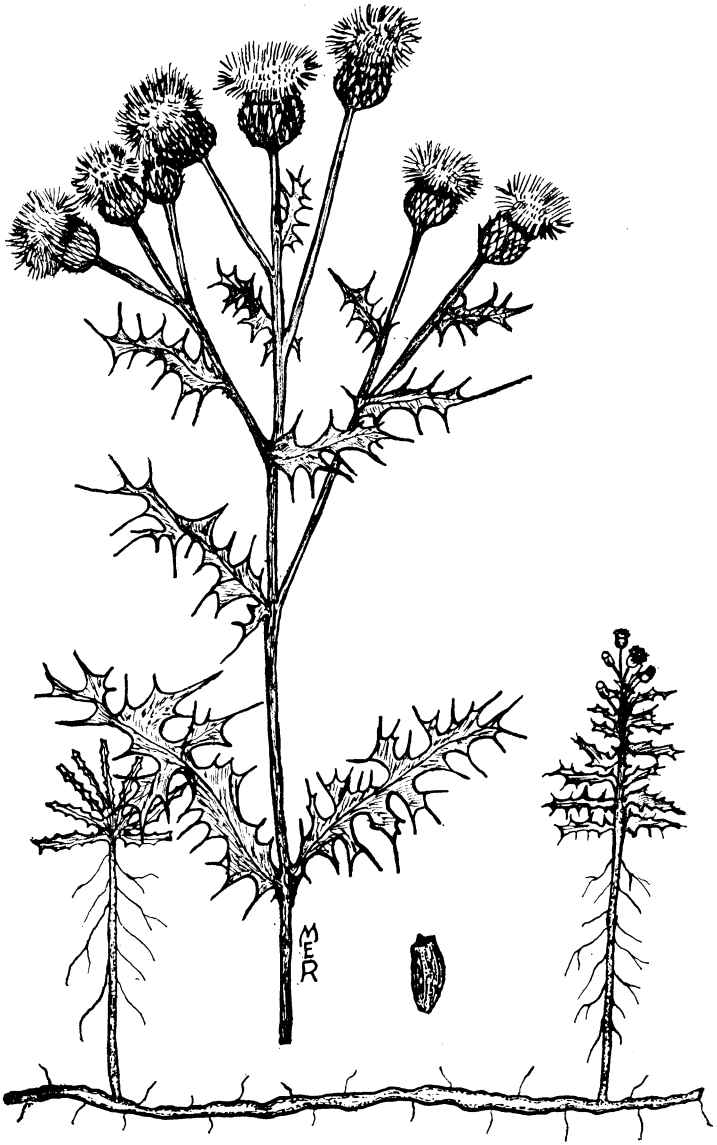

Fig. 32
Cirsium arvense (Canada Thistle)

221. **Centaurea cyanus** L. Bachelor's-button. Blue-bottle. Corn Thistle. Cornflower.— Woolly-hairy, slender, erect, leafy stem with ascending branches; alternate, sessile, linear or narrowly lance-shaped, bristle-tipped, woolly-hairy leaves, the lower ones often sparingly toothed, the upper entire; and long-stalked, solitary, terminal heads composed of showy, purple, blue, pink, or white flowers. Marginal flowers usually neutral, funnel-form with spreading ray-like lobes; central flowers bisporangiate, fertile, smaller, tubular; involucre ovoid, with several rows of appressed, greenish-yellow bracts, the outer shorter, all fringed with colorless teeth; achenes grayish, broadly oblong, slightly flattened, shining, notched on one side near the rounded base, crowned with a brush-like cluster of unequal, light brown bristles.

Annual or biennial introduced from Europe; propagated by seeds. Flowering period: summer and fall.—An escape from cultivation in gardens to roadsides, waste ground, and sometimes to grainfields; not a common weed in Ohio.

Control.—Prevent seed production by hand-pulling, hoe-cutting, close mowing, or clean cultivation of a hoed crop.

222. **Centaurea solstitialis** L. Barnaby's Star-thistle. Star Thistle.— Woolly-hairy, rigid, erect, leafy, often widely branched stem, winged by the decurrent leaf bases; alternate, sessile, woolly-hairy leaves, the basal ones pinnately divided into a large terminal lobe and narrow lateral segments; the stem leaves small, lance-shaped to linear, generally entire; and solitary terminal heads composed of small, tubular, bisporangiate, yellow flowers. Involucre ovoid to globose, with several rows of appressed bracts, the principal ones tipped with long, stout, yellow spines, but the outer ones with palmately branched prickles; achenes similar to those of the preceding species, but lighter in color and crowned with fewer, longer, white bristles.

Annual introduced from Europe; propagated by seeds. Flowering period: summer and fall.—Chiefly a weed of roadsides and waste ground, but sometimes in meadows and pastures; not a common weed in Ohio.

Control.—Same methods as for bachelor's-button.

Note.—The seeds are frequently an impurity in western alfalfa seed.

CICHORIACEAE. Chicory Family

223. ***Cichorium intybus** L. Chicory. Wild Succory. Coffee-weed.— Erect, often reddish, sparingly bristly-hairy stem with rigid, ascending branches that become somewhat woody when old; thin, somewhat rough leaves with short, bristly hairs, especially along the margin and midrib beneath, the basal ones narrowed to petioles, arranged in a rosette, spatula-shaped or oblong lance-shaped in outline, but pinnately cleft into backwardly turned lobes or teeth with long, soft points; the stem leaves alternate, small toward the top, oblong or lance-shaped, pinnately cleft, toothed or entire, clasping by ear-like basal lobes; and numerous, sessile heads of bisporangiate, blue or whitish flowers in clusters of 1-4 along the nearly naked branches. The corolla consists of a short tube and a strap-shaped, 5-toothed ray; the involucre is composed of herbaceous bracts, the outer ones spreading, the inner ones erect. The fruit is a flattened, somewhat wedge-shaped, ribbed, brown achene crowned with 2-3 rows of blunt, chaffy scales. This plant has milky sap.

Perennial introduced from Europe; propagated by seeds and by offsets from the crown. Flowering period: summer and fall.—Chiefly a weed of roadsides, meadows, pastures, vacant lots, and waste ground. It will thrive in rather poor soils; rather general distribution in Ohio, but most abundant in the western half of the State.

Control.—Deep hoe-cutting or spudding below the crown is satisfactory for small areas. An application of salt will help to prevent sprouting. The long fleshy taproot may be pulled out when the ground is soft. Large infested areas of pasture or meadow can be destroyed by fall plowing to expose the roots, followed by a cultivated crop. A heavy stand of alfalfa is valuable as a smother crop. Permanent pastures, as well as roadsides and waste land, should be mowed often enough to prevent seed production. Sheep graze readily on the succulent tufts of basal leaves.

Notes.—The basal leaves are a satisfactory source of greens. The dried, ground roots are to many people an agreeable adulterant or substitute for coffee.

224. **Apargia autumnale** (L.) Hoffm. (*Leontodon autumnalis* L.) Fall Hawkbit. Fall Dandelion.— A basal rosette of smooth or slightly hairy leaves, narrowly oblong to linear lance-shaped in outline, but pinnately cleft into narrow, backwardly turned lobes, or sometimes with short, coarse teeth, all narrowed to short petioles; and a slender, scaly stalk bearing heads of bisporangiate, yellow flowers singly at the ends of its branches. The

Fig. 33

a. **Leontodon taraxacum** (Dandelion)
b. **Sonchus asper** (Spiny Sow-thistle)
c. **Cichorium intybus** (Chicory)
d. **Sonchus oleraceus** (Common Sow-thistle)

corolla consists of a short tube and a strap-shaped, 5-toothed ray; the ovoid involucre is composed of 1-2 rows of nearly equal bracts, as well as shorter outer ones. The fruit is an oblong, ridged, beaked, brown achene crowned with a funnel-shaped row of plume-like, yellowish-white bristles. This plant has milky sap.

Perennial introduced from Europe; propagated by seeds and by short, thick, shallow, horizontal rootstocks that bud new plants at close intervals. Flowering period: summer to late fall.—A weed of meadows, pastures, lawns, roadsides, and waste places.

Control.—Spudding or deep hoe-cutting is satisfactory for small areas. Fall plowing to expose the shallow rootstocks, followed by a cultivated crop, is advisable on large areas. The flower-stalks should be mowed before bloom. Sheep will destroy the tops of this weed. Thin, permanent pastures infested with this weed are improved by several treatments with a spring-tooth harrow, followed by reseeding.

Note.—The tufted growth of leaves from the short, clustered rootstocks is often sufficiently dense to crowd out grasses.

225. **Sonchus arvensis** L. Field Sow-thistle. Corn Sow-thistle.— Smooth, finely grooved, stout, often tall, erect stem with branches toward the top; alternate, smooth, dark green leaves toothed with small, weak spines, the basal and lower ones narrowed to margined petioles, pinnately cleft into a large, pointed, terminal lobe as well as rather distant, successively smaller, backwardly turned, lateral segments along a broadly margined midrib; the upper leaves lance-shaped in outline, pinnately cleft or entire, sessile, clasping; and large, showy, stalked heads of bisporangiate, bright yellow flowers in a loose terminal cluster. The corolla consists of a tube and a long, strap-shaped, 5-toothed ray; the involucre is composed of several rows of narrow, over-lapping, glandular-hairy bracts, successively larger toward the inside. The fruit is a small, oblong, flattened, ribbed, transversely wrinkled achene crowned with fine, white, copious bristles. This plant has milky sap.

A deep-rooted perennial introduced from Europe; propagated by seeds and by deep, creeping, horizontal rootstocks that bear new plants at frequent intervals from buds at the nodes.—A weed of cultivated and waste ground, grainfields, and roadsides. It grows under diverse soil conditions but thrives best in moist, fertile soils; reported from several counties of Ohio.

Control.—Prevent seed production and either remove or starve out the rootstocks. New patches of this weed should be attacked with the same vigorous persistence as Canada thistle or quack-grass and, if possible, during the early rosette stage when the rootstocks are still short and easily eradicated. Digging is satisfactory for small patches. The rootstocks should be removed, collected, and burned. Later inspections are necessary to insure complete eradication. Close hoe-cutting will gradually starve out the underground parts. Smothering with tar paper is adaptable only on small areas.

Stands of this perennial on tillable land can be brought under control or entirely eradicated by using a rotation that includes both cultivated crops and either smother crops, like buckwheat and spring grains, or longer growing ones, as sweet-clover, alfalfa, and grasses. Both fall and spring plowing, followed by repeated cultivation, are advisable. Bare fallowing is an effective but costly method advisable only when other methods prove inadequate. Repeated mowing of pastures and waste ground is necessary. Sheep and hogs will eat this weed.

Investigators in Minnesota have reported satisfactory killing of field sow-thistle with the chlorates.

Notes.—This plant is rated as one of the most persistent and aggressive weeds in both the northwestern states and the Canadian provinces. Each plant produces a large number of fruits that are easily and widely disseminated by winds. The mat-like habit of growth from the ever lengthening rootstocks effectively smothers and reduces yields from crop plants. Eradication is both difficult and costly when this weed has become well established.

226. ***Sonchus oleraceus** L. Common Sow-thistle.— Smooth, grooved, erect, often tall, sparingly branched stem; smooth, alternate leaves toothed with small, weak spines, the basal and lower ones tapered to narrowly margined petioles, pinnately cleft into a large, triangular, terminal lobe, as well as narrow, successively smaller, lateral segments along a narrowly margined midrib; the upper leaves pinnately cleft, sessile, clasping by pointed basal lobes; and stalked heads of pale yellow flowers in crowded, mostly terminal clusters. The flowers are similar to those of the preceding species but in smaller heads; the involucre is smooth when mature. The fruit is an oblanceolate, flattened, ribbed, transversely wrinkled, reddish-brown achene crowned with silky, white bristles. This plant has milky sap.

Annual naturalized from Europe; propagated by seeds. Flowering period: late spring to the end of the season.—In cultivated ground, yards, grainfields, along roadsides, and in waste places; general distribution in Ohio.

Control.—The methods recommended are: hoe-cutting, hand pulling, or clean cultivation of a hoed crop; and surface cultivation of badly infested grainfields after harvest. Plants in waste ground should be mowed before bloom. As far as possible, roadsides and other waste ground should be seeded to perennial grasses to form a dense sod in which this weed and other annuals become established with difficulty. Sheep help to keep it under control.

Note.—The fruits are disseminated chiefly by winds.

227. ***Sonchus asper** (L.) Hill. Spiny Sow-thistle.— Smooth, grooved, erect, often tall, sparingly branched stem; alternate, smooth, dark green leaves with prominently and rigidly spiny-toothed margins, the basal and lower ones spatula-shaped, narrowed to margined petioles, generally undivided, but if pinnately cleft the midrib broadly margined; the upper leaves oblong or lance-shaped, sessile, clasping by rounded basal lobes. The heads and pale yellow flowers are similar to those of the preceding species. The fruit is an oblong, flattened, ribbed, reddish-brown achene crowned with silky, white bristles. This plant has milky sap.

Annual naturalized from Europe; propagated by seeds. Flowering period: late spring to the end of the season.—In cultivated and waste ground; general distribution in Ohio.

Control.—Same methods as for common sow-thistle.

228. **Lactuca canadensis** L. Tall Lettuce. Wild Lettuce.— Smooth, slender, tall, erect stem with branches toward the top; alternate gray-green leaves varying from spatula- to lance-shaped in outline, but mostly pinnately cleft into a pointed terminal lobe, as well as smaller, unequal, lateral segments, often somewhat spiny-toothed, the basal ones narrowed to margined petioles; the stem leaves sessile or clasping by basal lobes, sometimes merely entire below the inflorescence; and numerous, small, short-stalked heads of 12-20 bisporangiate, yellow flowers in a loosely branched terminal cluster and small, axillary ones. The corolla consists of a tube and strap-shaped, 5-toothed ray; the cylindrical involucre is composed of several rows of ovate outer bracts shorter than the linear, inner ones. The fruit is a dark, oval, flattened achene with 3 ribs on each face; it is tipped with a slender beak enlarged into a disk bearing copious, white bristles. This plant has milky sap.

Native biennial or annual, propagated by seeds. Flowering period: summer and fall.—In fields, gardens, fencerows, and roadsides; general distribution in Ohio.

Control.—Same methods as for prickly lettuce.

Note.—The fruits are disseminated widely by winds.

229. ***Lactuca virosa** L. (Incl. *Lactuca scariola* L.) Prickly Lettuce. Strong-scented Lettuce.— Generally tall, stiff, erect, branched stem, often bristly-hairy near the base; alternate, sessile or clasping, variable, light green leaves, oblong or broadly lance-shaped in outline, undivided or more often pinnately cleft into broad lobes, smooth except for numerous prickles or stiff hairs on the whitish midribs beneath, as well as weak spines along the wavy-toothed margins; and very numerous, small, short-stalked heads of 6-12 yellow flowers in a large, spreading, terminal cluster and on short, axillary branches. The flowers and involucre are similar to those of the preceding species. The fruit is a dull, dark, obovate, flattened, ribbed achene tipped with a thread-like beak bearing copious white bristles. This plant has milky sap. It is one of the so-called "compass plants"; in sunny habitats the leaves tend to assume a position edgewise to the direction of strongest light.

Annual or winter annual naturalized from Europe; propagated by seeds. Flowering period: midsummer to late fall.—Chiefly a weed in cultivated ground, old meadows, grainfields, pastures, fencerows, roadsides, and vacant lots; it is not limited by the type of soil or crop; general and abundant in Ohio.

Control.—Prevent seed production. Hand-pulling for scattered plants in meadows and grainfields is recommended. Spudding or hoe-cutting below the crown is satisfactory for small areas. Clean cultivation will bring it under control. Shallow plowing and surface cultivation subsequent to harvest of a badly infested grain crop are often advisable. Seeding down to a heavy stand of grasses is helpful. Roadsides and waste ground should be mowed as suggested below. The cutter-bar should be set high at the first mowing, so that the heads produced later on the same plants can be caught by a subsequent, lower mowing. Plants with partly mature fruits should be burned.

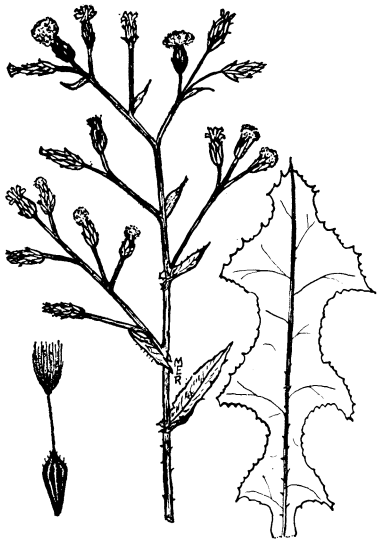

Fig. 34

Lactuca virosa (Prickly lettuce)

Notes.—Each plant produces a large number of fruits that are widely disseminated by wind. The seeds are often distributed in grass and clover seed. Grazing animals will eat the young succulent plants when pasture is short. Some dairymen claim that milk products are tainted when this plant is consumed in quantities. The plants stool freely and bloom close to the ground when mowed.

230. ***Lactuca saligna** L. Willow Lettuce.—Smooth, slender, erect stem with slender, erect or ascending branches; smooth, alternate leaves clasping by an arrow-shaped base, oblong to linear in outline, either undivided or more commonly pinnately cleft into narrow, pointed, distant, backwardly turned lobes along a smooth, narrowly margined midrib; and small, short-stalked heads of 6-12 yellow flowers in a narrow, terminal cluster. The fruit is an oblong achene tipped with a thread-like beak bearing white bristles. This plant has milky sap.

Annual or biennial introduced from Europe; propagated by seeds. Flowering period: summer and early fall.—A weed of waste and cultivated ground; it is most abundant in the central and western counties of Ohio.

Control.—Same methods as for prickly lettuce.

231. ***Leontodon taraxacum** L. (*Taraxacum taraxacum* (L.) Karst. *Taraxacum officinale* Weber.) Dandelion.— A basal rosette of leaves sparsely covered with long, scattered hairs at least when young, oblong or spatula-shaped in outline and nearly uncut but becoming pinnately cleft into segments toothed with long, soft points when old, all narrowed to short, margined, usually hollow petioles; and a smooth, hollow stalk generally bearing a single, large head composed of numerous, bisporangiate but parthenogenetic, golden-yellow flowers. The strap-shaped ray is 5-toothed at the tip; the involucre is composed of short, spreading, outer bracts as well as an inner row of erect linear ones. The fruit is an oblong, brown achene with tubercled, longitudinal ribs; it is tipped with a very long, thread-like beak bearing copious white bristles that form a perfect parachute. This plant has milky sap.

Perennial naturalized from Europe; propagated chiefly by seeds. Flowering period: mostly during spring and early summer but to some extent throughout the season.—A weed of lawns, pastures, meadows, strawberry beds, roadsides, and waste places but seldom troublesome in cultivated soils; general and very abundant in Ohio.

Control.—Consult the section on methods of control and eradication for certain noxious perennial weeds.

Notes.—The numerous seeds are widely dispersed by winds. They are often an impurity in grass seeds. Broken pieces of the long, fleshy taproot or parts of the crown of old plants will produce new plants when buried in moist soil. The succulent young leaves are a valued source of greens during early spring.

DISSEMINATION OF WEEDS

The introduction and dissemination of the seeds, fruits, and vegetative structures of weedy plants is accomplished by a number of agencies, which may be grouped conveniently under natural and human agencies.

Man has little or no control over the activities of natural agencies. A brief discussion of them serves to emphasize the necessity of both individual and community effort directed toward the prevention of seed production by weedy plants. Both public lands and corporation property should be subject to the same obligation in this matter as the small landowner.

Wind.—Nearly all fruits and seeds are disseminated to some extent by air currents. Ordinary winds carry fruits and seeds to adjacent fields and farms, while strong winds and cyclones disseminate them over much wider areas. Fruits and seeds that possess a parachute-like tuft of hairs are disseminated most widely by winds. Common examples are the fruits of plants belonging to the sunflower and chicory families, such as the thistles, dandelion, and prickly lettuce, as well as seeds like those of the milkweeds. Some fruits, like those of the docks, field penny-cress, and some members of the carrot family, are winged sufficiently to be readily distributed by a strong wind. To a lesser degree winged seeds, such as yellow toadflax, are carried by winds. In some instances, the heads of grasses that have long awns or bristles are rolled along over the ground. Common examples are squirrel-tail barley and the foxtail-grasses. A mature plant may be broken off and rolled over the ground, scattering seeds until it is caught in a fence or other entanglement. Such plants are aptly termed tumbleweeds; well known examples are the panic-grasses, tall hedge-mustard, tumbleweed (Amaranth), and Russian thistle. Small, light seeds from tall plants are readily blown about even though they have no structures that adapt them for wind dissemination, and, likewise, the seeds of low plants, such as the chickweeds, purslane, and speedwells, are scattered to a limited extent by winds.

Wind and snow are often operative in the dissemination of fruits and seeds that are borne on upright stalks. They are readily blown over the smooth surface of hard, frozen snow. Careful examination of snowdrifts along roadsides and fences has revealed a surprising number and variety of weed fruits and seeds. Those of foxtail-grasses, pigweeds, evening-primrose, and ragweeds are distributed quite widely in this way.

Water.—The fruits and seeds of weeds are often washed into streams during heavy rains or they may fall from plants growing on the banks. Some fruits float readily because their loose, outer coats contain air. Notable examples are the sedges, docks, and ground-cherries. The seeds of wild oats, lamb's-quarter, pigweeds, and dandelion are buoyant enough to float readily and fail to become water-logged after considerable soaking. All seeds are carried by strong currents. These fruits and seeds are deposited in lowland fields and waste ground during periods of overflow and thus the weed problem is an ever-present one in many alluvial soils.

Animals.—Some seeds, for example, those of the pepper-grasses, plantains, and some mustards, are mucilaginous when wet and are easily attached to the feet of both animals and man. All seeds may be imbedded in mud and disseminated in this way.

The fruits of a number of weeds possess barbs or hooked prickles that are easily attached to the coats of animals or to clothing. Squirrel-tail barley, sandbur-grass, the agrimonys, cockleburs, and beggar-ticks are readily disseminated in this manner.

Birds.—Doubtless a surprising number of weed seeds are disseminated yearly by birds. The seed of edible berries, such as those of the barberry, pokeweed, poison ivy, and the nightshades, frequently pass through the alimentary tract with unimpaired germination and often the berries are carried some distance before they are eaten. Birds also devour surprisingly large numbers of smaller seeds, such as those of the foxtail-grasses, pigweeds, sheep sorrel, mustards, chickweeds, yarrow, and dandelion. However, birds destroy countless seeds yearly, as well as injurious insects, and this usefulness far outweighs the harm they do as disseminators of weed seeds.

Explosive fruits.—The seeds of a few weeds are thrown several feet from the parent plant by a sudden contraction or twisting movement of the fruit. This limited method of seed dissemination occurs in Oxalis, Geranium, Euphorbias, and some of the vetches.

Hygroscopic movements.—The grasses that have a long, stiff, twisted awn on the grain have this interesting but very limited method of dissemination. During dry weather the awn is twisted tightly, but during wet periods the awn untwists and becomes straight. This alternate twisting and untwisting carries the seed for short distances over the ground or buries it more deeply in the soil.

Human activities are responsible for a wider dissemination of weeds than are natural agencies. By intelligent, individual, and cooperative effort man can exercise a large measure of control over them.

Crop seeds.—Doubtless, the use of impure agricultural seeds is responsible for a wider dissemination of weed seeds than any other means. Many of our most troublesome weeds were first brought into this country in agricultural seeds. Russian thistle was brought into the Dakotas as an impurity in flax seed by a colony of Russians. Within a few years it had spread over that section. Tall hedge-mustard was imported from Europe in impure seed. Within twenty-five years it was widely spread over the United States. The well-known Canada thistle was introduced in the same way. There is always considerable risk attendant upon the introduction of weed seeds from a foreign country or from a widely separated section of the same country. Frequently, weeds that are only of minor importance in their original habitat prove very troublesome when transferred to a new habitat. Crop seed produced under and adapted to local conditions, that has good size, good color, high germination, and is reasonably free from weed seeds, is always preferable. Even a dozen weed seeds in each bushel of crop seeds sown are often sufficient to account for the introduction of a new weed pest.

The purchase of cheap, doubtful seeds from an unreliable source always involves a considerable risk. Some weed seeds are so small that they easily escape notice; others closely resemble some crop seeds. Careful cleaning after purchase is not always satisfactory. The seeds of some weeds are practically inseparable from certain crop seeds because of similarity in size or weight, and others are separated only with difficulty. Weed seeds with projections on the surface and awned grass seeds badly clog the cleaning screens. When the least doubt exists, the grower should accept seed only after it has been carefully examined for purity by a seed analyst. No system of weed control will be satisfactory as long as a fresh supply of weed seeds is introduced yearly with the crop seeds sown.

Forage.—Weed seeds are often scattered in forage, especially hay; for instance, the seeds of quackgrass and squirrel-tail barley are known to have been widely disseminated in alfalfa hay. Weedy forage should be regarded with as much suspicion as impure crop seeds.

Screenings and commercial feeds.—Screenings and some commercial feeds contain a high percentage of weed seeds. A few of them such as corn cockle are mildly poisonous; a large proportion of

them are the seeds of troublesome weeds. Feeds of this type should be purchased only from manufacturers who grind the feeds fine or heat them sufficiently to destroy the vitality of the weed seeds.

Manure and refuse material.—Forage, straw for bedding, grain, and commercial feeds are the sources of weedy manure. When these materials are known to contain weed seeds the manure should never be placed on the fields without thorough composting.

Wool.—The fruits and seeds of weeds with spines or prickles, such as cocklebur and beggar-ticks, are frequently carried in the fleece from one field, farm, or section of the country to another. Buffalo-bur has been disseminated in this manner. The refuse material around woolen mills often contains weed seeds removed in cleaning the fleeces.

Escaped plants.—Some of our most troublesome weeds were formerly held in high esteem either for food or ornamental planting. Well-known examples are oxeye daisy, chicory, yellow toadflax, and bouncing-Bet. Plants that reproduce readily by seeds or by perennial, vegetative parts should be watched with extreme care to prevent them from becoming pests in garden or field.

Nursery stock.—The rootstocks, roots, and the seeds of weedy plants are sometimes introduced with nursery stock. The underground parts of quack-grass and Canada thistle have been introduced in soil clinging to the roots of ornamental plants. Nursery stock should be examined carefully at planting and for a year or so thereafter.

Packing material.—A cheap, weedy grade of hay or straw is sometimes used to pack nursery stock and various kinds of merchandise. Such material should be burned immediately; it should never be scattered about the premises.

Farm machinery.—Weed seeds may be scattered from wagons and trucks over a considerable distance. Weed seeds, especially those with mucilaginous coats, are easily transported in mud and moisture on the wheels. The underground parts of weeds may be dragged to an uninfested area on plows, harrows, and cultivators. Weed seeds are frequently transported through failure to clean up binders, threshing outfits, and hay presses properly before they are moved from one location to another.

Common carriers.—The annual movement of grain, forage, and livestock often results in the wide dissemination of weedy plants. Weed seeds fall along the tracks during transit and about the premises at the destination of the shipment. The resultant weeds

soon spread to adjacent farm lands. Many weeds new to a locality spring up around the refuse heaps of stockyards. Such weeds come from seeds in weedy grain, forage, and bedding used during the shipment of livestock. The shipper and consignee are responsible rather than the railroads. Such weedy refuse should be burned or thoroughly composted. Ballast heaps around ocean and lake ports are frequently covered with many new plants. Some of them eventually become weed pests.

DORMANCY AND LONGEVITY OF WEED SEEDS

A seed that fails to germinate as soon as it falls from the parent plant is said to exhibit dormancy or delayed germination. The seeds of both weedy and cultivated plants fall into two general classes with respect to their habits of germination. The seeds of the majority of cultivated plants, as well as those of numerous weeds, will germinate immediately after they fall from the parent plant, provided the external factors of temperature, moisture, and oxygen are favorable. The seeds of a few cultivated plants and those of a considerable number of weeds fail to germinate as soon as they are shed, even though the external factors are favorable for germination. Such seeds remain dormant until certain definite changes have taken place within the seed coats or the embryo. Internal dormancy serves to carry the seeds of some weeds over an unfavorable season; for example, the seeds of wild oats do not germinate until the season after they are produced. The seeds of cultivated oats germinate the same season and are killed by freezing. Delayed germination, whether due to external or internal causes, helps to provide a more or less continuous weed cover, once the soil has become badly fouled with seeds.

The seeds of weeds that bloom late in the season more commonly have the type of dormancy that is due to internal causes. This type of dormancy is usually terminated after several months; it sometimes continues over a year or more. Seeds with hard or thick seed coats usually remain dormant longer than those with soft, thin ones. Alternate freezing and thawing, as well as the action of soil bacteria and fungi, tend to shorten the period of dormancy by bringing about physical and chemical changes in the seed coats or the embryo.

The cause of internal dormancy varies with different seeds. Some seeds have hard or thick coats that prevent the intake of water; for example, the seeds of some legumes. Dormancy in some seeds is due to the fact that the seed coat prevents the entrance of

oxygen. This is true for the cockleburs. The seed coat is sometimes sufficiently tough to prevent the expansion of the embryo by the absorption of water; the pigweeds, peppergrasses, and shepherd's-purse fall into this class. Some seeds must undergo a period of after-ripening during which the embryo develops acidity; the ragweeds and hawthorn belong in this group.

The longevity of seeds in dry storage has been studied by several investigators. Ewart in Australia made germination tests on the seeds of over 600 species of plants stored in herbariums. He found that the seeds of relatively few species may be expected to remain viable longer than 15 years. The legume, mallow, and mint families were among those represented. A number of samples from the genus *Brassica* gave good germination after 12, but none after 15, years. The work of a British Association Committee reported by Brenchley indicated that from 3 to 8 years of dry storage are critical for the seeds of a number of weeds. Some legume seeds have been known to retain their viability in dry storage from 50 to 80 years. Seeds in dry storage may be expected to show greatest longevity when a low, uniform temperature and relatively low moisture conditions are provided.

The longevity of weed seeds buried in the soil has always aroused considerable interest and speculation because of the direct relation to the problem of weed control. Farmers have often been amazed at the sudden appearance of large numbers of weeds when a relatively weed-free meadow or pasture was plowed and put under cultivation. An experiment to determine the longevity of buried seeds was started by Beal in 1879 at the Michigan Agricultural College. Twenty lots of the seeds of 20 species of plants, mostly common weeds, were prepared and buried in the following manner. Fifty seeds of each of the 20 species were mixed with moderately moist sand taken from 3 feet below the surface. The mixture was placed in an uncorked bottle and buried in sandy soil at a depth of 20 inches, with the mouth of the bottle slanting downward to prevent the accumulation of water. One bottle has been taken up every 5 years and the enclosed seeds tested for germination. Ten species showed some germination in the test made after 40 years. The germination percentages of the five highest are given below.

Amaranthus spp.	68%
Oenothera biennis	38%
Brassica nigra	18%
Rumex crispus	18%
Plantago major	10%

It is also interesting to note that *Lepidium virginicum* gave some germination at the end of each 5-year period.

A similar experiment was started by Duvel of the United States Department of Agriculture at Washington, D. C., in 1902. He used 107 species, many of them weeds. The experiment differed from that of Beal in that the mixture of seeds and sterilized clay soil was placed in a porous flower pot covered with a porous saucer, thereby exposing the seeds to nearly normal conditions of moisture and oxygen supply. The pots were buried in a trench at three levels; namely, 6-8, 18-22, and 36-42 inches. Duvel's report at the end of a year showed that cultivated plants, with few exceptions, had lost their vitality when buried in the soil, but the seeds of weedy plants had not done so. Hard seeds of the same species retained their vitality better than those with soft seed coats. The experiment was summarized by Goss in 1923 after 20 years. He found that the seeds of 51 species produced sprouts at that time in contrast to 71 in 1903 after one year of burial. Seeds buried at the greater depths in general gave slightly better germination than those at the shallow depth. This was doubtless due to the low, uniform temperature, moisture, and oxygen supply at the greater depths. The weed seeds that gave the highest germination and the fewest failures were all from common and persistent weeds of the locality.

The longevity of weed seeds in manure has been studied by Oswald at the Maryland Station. He placed 52 kinds of weed seeds in both horse and cow manure, as well as in a mixture of equal parts of them. He found that only a few seeds germinated after 3 months and none after 6 months. He further determined that after burial in manure for one month, only seeds with hard, thick coats such as plantains, horse-nettle, ragweed, and a few others gave germination. Pammel at the Iowa Station found that exposure of 31 kinds of weed seeds in horse manure for 5 weeks resulted in germination in no case higher than one per cent.

The following practical applications can be made of the foregoing brief statements with respect to the longevity of weed seeds. Plowing under seed-bearing weeds to destroy the seeds is an unprofitable farm practice. It merely delays the problem to a later date. A few weed seeds will be destroyed, but those of the more troublesome ones will remain dormant but viable much longer than the normal crop rotation. A subsequent plowing will bring them near the surface and hence under favorable conditions for germination. Deep plowing only serves to put the majority of weed seeds under even better conditions for remaining dormant but viable over

an extended period. The aim should be rather to keep weed seeds in the upper layer of soil by shallow plowing and by subsequent cultivation to induce rapid germination.

Manure known to contain a large number of weed seeds should be composted for a period of from 2 to 3 months. The loss in fertilizer value will be offset by freedom from viable weed seeds.

The refuse material at the bottom of stacks and mows provides fairly good dry storage for weed seeds. Such material should be burned or composted when known to contain weed seeds in any amount.

CLASSIFICATION OF WEEDS

Plants are classified as annuals, winter annuals, biennials, and perennials in accordance with the duration of their life cycle.

Annuals.—The life cycle of annual plants is completed within one year. Annuals are propagated only by seeds and die after the production of a new crop. Plants of this class are known also as summer annuals. Common examples are the foxtail-grasses, pigweeds, lamb's-quarter, and Roman ragweed.

The root systems of annual plants exhibit some intergradation, but the following general types are recognized: (1) a cluster of numerous, slender, fibrous roots; (2) several prominent roots with fibrous branches; and (3) a relatively slender tap root with fibrous lateral branches. The extent of the root system of weeds, as well as cultivated plants, is influenced by the texture, aeration, and moisture supply in the soil.

The aerial habits of growth of annual weeds likewise vary considerably but the general types are as follows: (1) erect weeds, such as lamb's-quarter; (2) tufted weeds, such as common chickweed; (3) trailing weeds without nodal roots, such as moneywort; and (4) climbing weeds, such as black bindweed. The last two types are the most troublesome when firmly established.

As a rule, the quantity of seeds produced by annuals is large. It has been estimated that a single plant of corn mustard, foxtail, or pigweed may produce from 10,000 to 20,000 seeds and a single plant of purslane, over 1,000,000 seeds. The majority of annuals have a relatively short seeding period but some annuals, like common chickweed and purslane speedwell, produce flowers and seeds from early spring to late fall. Seed production is hastened during hot, dry seasons. Annuals whose seeds do not require a dormant period before germination often produce several successive generations within a single season.

Annuals are preeminently weeds of cultivated ground. As a rule, they become established much easier under such conditions than in the sod of meadows or pastures.

Winter annuals.—The life cycle of winter annuals extends through part of two seasons. Winter annuals are propagated only by seeds and die after the production of a new crop. The seeds germinate in the fall or after an extended dry period, survive the winter as hardy seedlings or immature plants, and produce seeds during the ensuing spring or early summer. When the seeds of winter annuals germinate in the spring the plants behave as annuals; so this class of plants may be true annuals, or, as winter annuals, they may approach the biennial habit of growth. Common examples are squirrel-tail barley, shepherd's-purse, and prickly lettuce. Their habits of root and top growth are similar to those of the true annuals.

Weeds of this type are most troublesome in meadows and grainfields because they produce seeds before the crop is harvested.

Biennials.—The life cycle of biennial plants extends through the greater part of two seasons. The active vegetative growth during the first season results in the storage of reserve food in thick, fleshy roots and short, compressed stems. The reproductive growth during the second season exhausts the supply of stored food, and the plant dies after the production of a new crop of seeds. Common examples are the mullens, wild carrot, the burdocks, and spear thistle. Biennial weeds are less abundant and troublesome than either annuals or perennials.

The majority of biennial plants have a prominent, fleshy, tap root system with small, fibrous, lateral branches.

The aerial, vegetative growth of biennials during the first season may consist either of a loose tuft of leaves, like wild carrot, or a typical rosette, like common mullen. The rosette is the commoner type. The flower-stalks of biennials are usually prominent and often branch readily at the base when mowed only once.

Biennial weeds are seldom troublesome in cultivated ground since they are easily destroyed by tillage during the first season or prevented from flowering by spring cultivation during the second season. They are most abundant in pastures, meadows, and waste ground.

Perennials.—The life cycle of perennial plants extends through more than two seasons. Perennials are propagated by seeds, but, in addition, they have vegetative organs, such as roots or underground stems that retain their vitality from year to year and either

simply maintain the plants or, by growth, enable them to spread to adjacent, uninfested areas. Thus, perennials are able to persist from year to year even though seed production is prevented. Common examples of perennial weeds are couch-grass, field bindweed, Rugel's plantain, and tall ironweed. Certain perennials occupy the ground so completely once they are established and are so aggressive and difficult to destroy that they are justly ranked among our most noxious weeds.

Perennial weeds may be conveniently classified under the following general types on the basis of the habit of growth of the underground, vegetative organs: (1) perennials with a root-crown; (2) perennials with creeping roots; (3) perennials with underground creeping stems; and (4) bulbous perennials.

Perennials with a root-crown.—Weeds of this type are propagated either by seeds alone or both by seeds and adventitious buds on the roots. The majority of root-crown perennial weeds are propagated only by seeds. The roots, or part of them, remain viable throughout the winter and produce new top growth in the spring from buds on the crown. The root system of a perennial of this type may consist of a cluster of fibrous roots or a more or less fleshy tap root with fibrous, lateral branches; for example, rib-grass plantain has numerous, small, rather shallow, fibrous roots; tall ironweed has long, thick, cord-like, fibrous roots that extend obliquely downward through a considerable soil area; and chicory has a fleshy tap root.

Perennial weeds of this type have a short, compact stem called a crown at or below the soil line. Such crowns have buds at the nodes, as do aerial stems. A new plant may result when part of the crown is broken off during cultivation. This is a limited method of vegetative propagation by stems. Root-crown perennials that have fibrous roots seldom, if ever, sprout when all of the crown is removed. Perennials with a fleshy tap root sometimes sprout from adventitious buds on the root even after the crown is removed or when the root is broken up during cultivation. This method of propagation occurs in dandelion. Small, fibrous roots are rather easily killed by desiccation, but thick, fleshy tap roots with a well developed cortex, such as those of curled dock, have been known to grow after air drying for twenty days.

Perennials with creeping roots.—Weeds of this type are propagated both by seeds and by creeping, more or less horizontal roots. The root may continue in a more or less horizontal direction for a distance of several feet and then bend obliquely downward to

form a vertical root. Adventitious buds along the horizontal creeping root, especially where it bends downward to form a vertical root, give rise to aerial shoots. The creeping root continues growth as a lateral branch. The creeping roots may be fleshy and the vertical roots also more or less so, as in Canada thistle. Studies by Kiltz[1] at the Nebraska Station show that horse-nettle differs from the above type in that the creeping roots are slender while the vertical roots are thick and somewhat fleshy. Field bindweed has very slender, shallow, creeping roots; as they grow through the soil, an aerial shoot and a vertical feeding root are formed. The vertical roots extend to a considerable depth in this case. The horizontal creeping root continues growth as a lateral branch. Kiltz further found that sheep sorrel has long, relatively shallow, creeping roots from which aerial shoots are developed by the growth of adventitious buds. The vertical roots are slender and fibrous. Old aerial shoots sometimes develop short branches near the surface that root at the nodes. Hence, this weed is also propagated to a limited extent by underground stems.

The foregoing examples illustrate the chief types of propagating root systems found among our common weeds, but it should be kept in mind that the extent and arrangement vary considerably with soil and climatic conditions. The root system extends farther down in a loose, cultivated soil than in the sod of meadows and pastures.

Perennials with underground stems.—Weeds of this type are propagated both by seeds and by creeping, horizontal, underground stems. Young stems are readily recognized by the presence of nodes and small, scale-like leaves; such features are less evident on old stems. Underground stems continue growth in a horizontal direction or, in some instances, turn upward to form shoots. They do not turn downward as creeping roots frequently do. In some instances, nut-grass (Cyperus) for example, the underground stem bears numerous, small tubers. Underground stems are also called rhizomes or rootstocks.

The underground stems of different weeds vary somewhat in appearance; for example, those of hedge bindweed are thickened and somewhat brittle whereas those of couch-grass are tough and fibrous. Buds at the nodes of these underground stems may develop into aerial shoots, roots, or secondary underground stems. The roots may remain short and clustered about the nodes, or they may extend downward to a considerable depth in the soil. When a

[1]Kiltz, B. F. Perennial weeds which spread vegetatively. Jour. Amer. Soc. Agron. 22: 216-234, 1930.

large number of tough, interlacing, underground stems is produced, the resulting dense growth is very difficult to remove. At least part of the underground stems remain alive through the winter months and start new growth the following season.

Popular literature dealing with weeds often uses the term rootstock as an inclusive one that may refer either to creeping underground stems or roots. The term is so used in this bulletin when it is not entirely clear as to which structures are concerned. From the standpoint of control, it is not always essential to know whether the structures are stems or roots, but, from the standpoint of accuracy, it is well to keep in mind that rootstock or rhizome should always refer to an underground creeping stem.

Underground stems, creeping horizontal roots, and fleshy vertical roots serve as storage organs for food reserves manufactured in the green, aerial parts of the plant. This stored food reserve furnishes the energy for growth of new shoots during the early part of the season and for the production of new shoots when the top growth is destroyed during the growing season. Production of new tops can continue until this food supply has been exhausted by the prevention of top growth over a considerable period.

Bulbous perennials.—Weeds of this type are propagated by bulbs and aerial bulblets, as well as to a very limited extent by seeds. The growth of new plants from bulbs and aerial bulblets increases the size of the infested area each year. The few weeds that belong to the lily family fall into this class. Field garlic is the most noxious because it produces both soft bulbs and hard-shelled bulblets, as well as aerial bulblets.

On the basis of top growth, perennial weeds fall into two general classes; namely, woody perennials and herbaceous perennials. The aerial stems of woody perennials, as well as the underground parts, persist from year to year, and growth is renewed from buds each spring. The blackberry is a common example. The aerial stems of herbaceous perennials die back to the ground at the close of each season and growth is renewed from buds on creeping roots, underground stems, root-crowns, or bulbs. Herbaceous perennial weeds are far more numerous and troublesome than woody perennial weeds.

The principal types of aerial growth found among herbaceous perennial weeds are as follows: (1) erect weeds, such as broadleaf dock and field sow-thistle; (2) tufted weeds, such as common mouse-ear chickweed; (3) climbing weeds, such as hedge bindweed;

(4) rosette plants, such as dandelion; (5) weeds rooting at the nodes, such as thyme-leaf speedwell; and (6) weeds with stolons, such as common five-finger.

Perennials with stolons or runners may spread over a considerable area during the growing season. The stolons do not survive the winter, but the roots of the young plants produced at their nodes do so and continue growth the next season. In this case, annual, aboveground stems are concerned in the propagation of a perennial.

In general, the number of seeds produced by perennial weeds is less than by annuals.

Perennial weeds, especially those with creeping underground parts, persist both in cultivated ground and in meadows and pastures.

THE CONTROL AND ERADICATION OF WEEDS

Effective methods of control and eradication must be based primarily on a knowledge of certain fundamental facts about the habits of the weeds concerned. They are briefly as follows: (1) the duration of the plants, whether annual, winter annual, biennial, or perennial; (2) methods of propagation, whether by seeds alone, as for annuals, biennials, and some perennials, or both by seeds and by vegetative structures, as for a number of perennial weeds; (3) approximate time of flower and seed production; and (4) the habits of underground and top growth. At least the common troublesome weeds of the locality should be recognized and these facts known about them.

Timely, intelligent, persistent effort throughout the season and over a period of years is the only way to subdue weeds with a minimum of labor and expense. There is no universal panacea for the weed problem; no simple, inexpensive, effortless operation that will insure weed-free premises. The individual who hopes to use a magic, armchair method is doomed to failure; while his neighbor who intelligently follows a definite program throughout the years will attain clean premises that yearly add to his financial reward and esthetic enjoyment.

The grower of crops should be familiar with all the time-tested methods by which annual, biennial, and perennial weeds can be kept down in the various situations in which they occur. He should be alert to take advantage of new and worthwhile methods that are developed from time to time. No method should ever be regarded

as an inflexible rule. The good judgment of the user is essential at all times in order to modify the method or change to others that best fit the particular situation.

Some individuals fail to begin the battle against weeds sufficiently early; others fail to continue until the end of the growing season. Good intentions and a definite program at the beginning often give way to half-hearted attempts toward the close of the season. Annual and biennial weeds are allowed to mature a late crop of seeds; perennial weeds are permitted to recover and produce considerable top growth.

The general principles and specific methods discussed in this bulletin may be grouped conveniently under (1) control of annual and biennial weeds and (2) eradication of perennial weeds.

CONTROL OF ANNUAL AND BIENNIAL WEEDS

The annual, winter annual, and biennial weeds are propagated only by seeds; consequently, any methods that prevent seed production will bring them under control when coupled with precautions that prevent the yearly introduction of a fresh supply of seeds from outside sources. All weeds are most easily and effectively destroyed before the root system has become established. Every effort should be made to induce rapid germination of weed seeds and to destroy the resultant plants during the seedling stage.

The above procedure is often difficult or impossible on cultivated land during a wet season and it is more or less impracticable for meadows, pastures, and waste areas at any time. Under such conditions every effort should be made to destroy annuals and biennials by the time the first flowers are open. Neglect past the early bloom stage is very apt to result in seed production. Weeds with succulent vegetative organs will often ripen seeds when they are uprooted or mowed during full bloom.

The life cycle of winter annual weeds extends through parts of two seasons, with seed production occurring early the second season. The seedlings or small rosettes can be destroyed most easily during the fall or early the following spring. The mature plants must be attacked early in the second season to prevent seed production.

The control of biennial weeds is essentially the same as for winter annuals. Biennial weeds are destroyed most easily during the first-year rosette stage before the fleshy tap root has become firmly established.

From the ideal standpoint, complete eradication of all weedy plants should be the aim; from the practical standpoint, good control is more feasible for annual and biennial weeds. Control measures that keep such weeds sufficiently reduced in number so that they neither interfere with the crop nor spread to uninfested territory to any extent are satisfactory.

MAINTENANCE OF SOIL FERTILITY

As a rule, weeds are least vigorous and abundant when growing in competition with a dense, healthy stand of crop plants. The previous statement is especially applicable to weeds in lawns, meadows, pastures, summer forage crops, and small grains—crops that by their habit of growth tend to crowd or shade out weeds. It is evident that the improvement and maintenance of soil fertility by the judicious use of fertilizer materials, by proper drainage, and by adjustment of the soil reaction to a point that is favorable for the crop plants concerned are important factors in the weed control program.

Fertilization.—A number of weeds thrive in unfertile soils that will not support a satisfactory growth of crop plants. Such weeds gradually decrease in numbers when the fertility of the soil is increased by the use of manure and fertilizers to a point where it will support a dense stand of crop plants; for example, oxeye daisy is a prevalent weed in poor meadows; it is much less so when in competition with a thick stand of clover or grasses. Liberal fertilization of a Kentucky blue-grass lawn established on limestone soils acts in a similar manner as a control measure for weeds.

Drainage.—Some weeds are prevalent only in poorly drained soils. The sedges and some smartweeds belong to this group. Adequate drainage permanently reduces the number of such weeds and also permits the growth of a satisfactory stand of crop plants, which is a further aid in control of the weeds.

Adjustment of soil reaction.—Adjustment of the soil reaction toward the alkaline side by the use of lime or toward the acid side by the application of acid fertilizers can sometimes be employed advantageously as a method of control for both annual and perennial weeds. Much yet remains to be learned regarding the applicability of this method of weed control.

It is generally recognized that the application of lime to correct acidity is usually necessary before a vigorous stand of red clover, sweet clover, or alfalfa can be grown on soils of shale or sandstone origin, even though they have been fairly well drained

and fertilized. Fortunately, liming for such crops acts indirectly as a method of weed control because a thick, shading stand of these legumes aids materially in keeping down such prevalent perennials of meadows as sheep sorrel and the plantains, as well as a number of annual weeds.

In contrast, experimental work by Dr. Welton at the Ohio Station shows that a number of common lawn weeds, such as crabgrasses, common chickweed, and dandelion, are less tolerant of a moderate soil acidity than the major turf grasses such as Kentucky blue-grass or bent-grasses. Hence, weed control in lawns established on neutral or slightly acid soils is materially aided by the regular application of acid fertilizers. Liming is not recommended until continued applications of acid fertilizers have made the soil so highly acid that a decrease in vigor of the turf grasses is evident.

Both fertilization and adjustment of the soil reaction are concerned in the reestablishment of thrifty, weed-free, permanent, blue-grass pastures on the soils of the eastern half of Ohio. It has been determined that the growth of white clover can be greatly increased by a liberal application of a carrier of phosphorus, such as superphosphate or basic slag, when supplemented by sufficient lime to adjust the reaction of the soil so that it is only slightly acid. As a result, the nitrogen content of the soil is increased and Kentucky blue-grass becomes abundant and crowds out the clover to a considerable extent. Such a condition prevails until the supply of nitrogen is depleted and the grass again gives way to white clover. As long as a vigorous growth of blue-grass and clover persists, annual and biennial weeds, as well as perennials such as Virginia beard-grass, the cinquefoils, yarrow, and oxeye daisy, are seldom, if ever, a problem.

ROTATION OF CROPS

Certain weeds become a problem when the same type of crop is grown continuously for several years. Some weeds are more commonly associated with tilled crops; some are prevalent in meadows and pastures; and another group, largely winter annuals that go to seed before harvest, is troublesome in the small grains.

A diversified system of crop rotation is essential both from the standpoint of profitable crop production and effective control of annual and biennial weeds. Timely use of the various cultural operations that may be employed during the growth of diversified crop types are generally the only measures necessary for their control in tillable land.

Crop rotations, of necessity, vary in different localities and fields as to length and as to the particular crops included to accord with the soil, climatic conditions, and type of farming followed. A short rotation that is completed in from 3 to 5 years is generally satisfactory. The rotation should include both cultivated and smother, or shading, crops.

The grower must not expect one rotation of 3 to 5 years to clear his fields completely of weedy annuals and biennials. The vitality of buried weed seeds, combined with natural dissemination, helps to provide at least a small supply of seeds that will germinate and give trouble when the rotation is repeated. Sometimes a particularly troublesome annual weed has been allowed to become so abundant that crops are grown only with difficulty. In such instances the rotation should be changed sufficiently to allow the use of intensive cultural measures until it is again under control.

HAND METHODS

Hand methods must be relied on for the control of annual and biennial weeds on small areas and to supplement machine cultivation, especially after the crop has been laid by.

Hoeing is satisfactory for the destruction of weeds that have a comparatively shallow root system. The plants should always be cut below the soil line to prevent subsequent growth from short basal branches.

Spudding is a useful method for tap-rooted biennials, as well as for annuals with a deep root system, especially when they are growing in sod land. The regular spud, a tool with a long, chisel-like blade, is designed particularly for the removal of weeds that have a fleshy tap root. Such plants should always be removed as far below the crown as possible.

Hand-pulling is most effective for weeds with tough, erect stems and a rather shallow root system. Deep-rooted weeds can be successfully removed only after a soaking rain or in loose soils.

CULTURAL METHODS

Plowing.—Shallow plowing is advisable to keep weed seeds within a few inches of the surface and hence under conditions favorable for germination. Deep plowing merely delays the problem of their destruction until a future date. Fall and winter plowing allow a longer period for the destruction of weed seedlings in the spring before the crop is planted.

Surface cultivation.—From the standpoint of weed control, the aim of surface cultivation is to induce germination of weed seeds and destroy the resultant weeds while they are in the seedling stage. The land should be worked up as early as possible in the spring and should be harrowed several times at intervals before the crop is planted. Thereby, numerous weeds are destroyed before the crop is large enough to interfere. The planting of the crop should be delayed as long as practicable to allow such treatment when the soil is known to contain a large number of weed seeds.

Shallow tillage both with the weeder and shovel cultivator should continue the work of destroying weed seedlings until the crop is laid by. Hand methods are often necessary after machine cultivation has been discontinued.

Surface cultivation during late summer and fall is advisable after the removal of a weedy grain crop. The field should be disked and harrowed at intervals to destroy weed seedlings, or, if preferred, the area may be plowed shallow and harrowed as often as a crop appears.

Spring weeding of grain crops is another application of the surface cultivation method. It is most effective for shallow-rooted annual and winter annual weeds, such as the mustards. The weeder is best suited to loose soils; the spike-tooth harrow is better for firm or stony soils. Weeding is successful only when the soil is fairly dry and preferably slightly crusted. It should be done before the grain plants are 6 inches high; otherwise, injury may occur. This operation is not advisable on light, sandy soils due to the danger of uprooting the grain plants.

Bare fallowing during all or part of the growing season is rarely necessary for the control of annual and biennial weeds as long as a diversified rotation is employed. It is recommended only for fields that through years of neglect have become so heavily seeded that it is virtually impossible to grow a cultivated crop without an unprofitable expenditure of labor.

A bare fallow is established by plowing to a shallow depth during spring or summer and following with surface cultivation until time to plant a winter grain crop or, if preferred, until the end of the season. Weekly harrowing is usually necessary during the summer. A second, later, deeper plowing is helpful in bringing a fresh supply of seeds near the surface.

SMOTHER CROPS

Annual forage crops, such as soybeans, cowpeas, millet, and buckwheat, help to crowd and shade out many annual weeds. A

healthy stand of alfalfa or clover also makes a desirable smother crop. The frequent cutting of alfalfa is a further aid in control.

SEEDING TO GRASSES

This method is applicable to such areas as roadsides, vacant lots, farm premises, and other more or less waste ground. Such areas are marked by numerous annual and biennial weeds that yearly furnish a supply of seeds to adjacent cultivated land. A good sod of a perennial, like Kentucky blue-grass, largely prevents the establishment of such weeds.

MOWING

Timely mowing must be depended on to prevent annual and biennial weeds from seeding on land that is not under cultivation.

Mowing should not be neglected past the early bloom stage. Two mowings are usually sufficient, the first one about the middle of June and a second about the middle of August. A third mowing is sometimes necessary during a wet season.

The first cutting of pastures and waste land should be high so that the subsequent mowing can be made low enough to catch flowers on side branches put out after the first mowing.

Badly infested meadows should be mowed early enough to prevent seeding by weeds, even at some sacrifice of the crop.

The removal of a grain crop permits the rapid growth of annuals, such as the foxtail-grasses and ragweeds. Clipping the stubble during late summer or fall not only prevents seeding but also provides a light mulch when clover has been seeded in the grain.

GRAZING

Grazing to a limited extent has the same effect as mowing but of course only for weeds that livestock graze on readily. Some weeds are avoided because of their bitter or acrid sap. Sheep are much more effective than cattle as weed destroyers because they graze closer and eat a greater variety of plants. A small flock will repay the owner for his care, aside from the wool crop, simply as agents of weed destruction.

BURNING

This is a method of last resort applicable to fencerows, roadsides, and other waste ground on which weeds have been allowed to mature a crop of seeds.

Dry weeds with attached fruits and seeds are best burned as they stand. Previous mowing merely scatters the seeds and those on the surface of the soil are seldom exposed to a sufficiently high temperature to destroy them. When mowing has been neglected past the full bloom stage, it is advisable to pile the weeds and burn them when dry.

ERADICATION OF PERENNIAL WEEDS

A large number of our perennial weeds are propagated by seeds and simply maintained for a number of years by perennial roots. This group needs no further consideration because the methods previously given for the control of annuals are adequate for them.

A number of perennial weeds are propagated both by seeds and by underground stems or creeping roots. Our most troublesome weeds belong to this group. Complete eradication should be the aim in dealing with them because of their tendency to occupy the ground to the exclusion of desirable plants. Methods suitable for such weeds must not only prevent seeding but also destroy the underground parts. Weeds of this type may be eradicated by (1) removal of the underground parts, (2) prevention of top growth until the underground parts have been starved out, and (3) chemical treatment.

REMOVAL OF THE UNDERGROUND PARTS

This method is of practical use only for patches with an area of a square rod or less. The soil should be removed to a depth sufficient to obtain the bulk of the underground parts and well beyond the limits of top growth. The soil should be carefully forked over to remove the vegetative parts before it is returned to the excavation. It is wise to collect and burn the underground stems or roots.

The area should be inspected at intervals during a season or so for the purpose of removing chance sprouts.

PREVENTION OF TOP GROWTH

Both underground stems and creeping roots serve as a place of storage for the organic food reserves that are built up in the green aerial portions of herbaceous perennial weeds. These food reserves are drawn upon to produce a new crop of shoots whenever the top growth is removed. Removal of the top growth as often as it

appears throughout one or more seasons brings about gradual starvation and finally death of the underground propagating organs.

Hand methods.—Small patches of perennial weeds can be killed out by hoe-cutting or spudding. The treatment is best started in June or at most not later than bloom. The shoots must be removed as often as they appear throughout the season. Careful work may complete the starvation process within a single season; a second season's work is usually necessary however.

Covering with tar paper or other material.—This method is suitable for patches with an area of 2 square rods or less. The cover used must exclude all light and be resistant to the growth of shoots.

Tar paper is frequently used on level ground. The tops should be cut close to the ground about bloom time. The strips of paper must be overlapped several inches to prevent the shoots from coming up between them. The paper should extend a foot or so beyond the edge of the patch and it should be held close to the ground with boards, stones, and dirt. It is advisable to leave the cover on until the end of the season. Straggling plants may survive but these are easily killed by hoeing the next season.

Thin sheet metal, old corrugated roofing, or manure piled to a depth of 2 feet makes a satisfactory cover.

Bare fallowing.—This method is frequently the most satisfactory one for destroying a heavy stand of certain perennial weeds when a large area is concerned.

As the term implies, an ideal bare fallow is one on which no green growth is permitted to appear. From the practical standpoint, a growth of from one to 2 inches does not impair the efficiency of the treatment. On the other hand, greater growth permits food storage in the underground parts, thereby prolonging their vitality.

Bare fallowing is most effective when started during midsummer. At that time the food reserves are low in the underground stems or creeping roots. The removal of a hay or grain crop offers a favorable situation. Furthermore, no serious loss of the use of the land is necessary when fallowing is begun at this time.

Bare fallowing should not be attempted during a wet season or on wet soils. It is not advisable on light, sandy soils that tend to leach badly.

Perennials with underground stems.—The field should be seeded down for meadow or pasture over a period of one or two

years to establish a root-bound condition. The area is then plowed during midsummer to expose the underground parts. Surface cultivation with the harrow both to prevent top growth and drag out the underground stems should follow until the end of the season. A summer smother crop or a cultivated crop may be planted the next season.

Perennials with creeping roots.—The method of fallowing used for this type of perennial differs from that employed for the preceding one only in that more emphasis must be placed on preventing top growth since creeping roots are usually too deep to be effectively dragged out. Tools such as the disk harrow, or cultivator equipped with sweeps are best adapted for keeping the top growth removed. The job of eradication can be completed the following season by clean cultivation of a tilled crop or by the use of a smother crop.

Intertillage of crops.—Cultivation with a crop on the ground differs from bare fallowing chiefly because the presence of the crop necessitates the use of different tools and the employment of considerable hand labor, both during and after cultivation has been discontinued.

Even a heavy infestation of a perennial weed that is propagated by creeping roots can be practically eradicated by two seasons in tilled crops providing hand labor is freely used. On the other hand, a heavy infestation of a perennial with underground stems should first be reduced by a period of bare fallowing before a clean tilled crop can be relied on to complete the job.

Smother crops.—Crop plants that are capable of crowding and shading perennial weeds to such an extent that they make only a feeble top growth cause starvation of the underground parts as do cultural methods but to a lesser degree. The maximum value is realized from a smother crop when it is seeded heavily on fertile soil during a season that provides moisture conditions favorable for rapid growth.

Buckwheat, soybeans, cowpeas, millet, sorghum, sunflowers, and, to a lesser degree, corn planted thickly for fodder are among the annual smother crops. Sugar beets are suitable because they are subject to intensive cultivation during the first part of the season and furnish dense shade during the latter part. A combination for the entire season is furnished by oats cut for hay, followed by a crop of soybeans or buckwheat.

Biennial sweet clover and alfalfa are the chief smother crops of longer duration. Alfalfa is preferable because it remains on the

ground longer, is cut frequently, and recovers quickly after mowing. An alfalfa field that is maintained primarily as a smother crop should be put under cultivation whenever the stand becomes thin.

Smother crops are usually employed to complete the eradication program after a perennial weed has been weakened by a period of bare fallowing or clean cultivation of a tilled crop.

Mowing.—This method is applicable to large areas of permanent pasture and waste ground. However, it is effective only for perennials with more or less erect stems, such as Canada thistle.

The first mowing should be made during the middle of May or not later than the first of June, followed by later mowings at monthly intervals until the end of the season. Close mowing is best. Several years' work is necessary with this method. The time can be shortened by mowing at intervals of 3, or even 2, weeks, especially during the summer months.

CHEMICAL TREATMENT

The recently introduced chlorates are the most promising chemicals for weed control at the present time because they are capable of destroying, with relatively few applications, both the tops and underground propagating parts of some of our worst perennials.

A number of chemicals are capable of killing out all herbaceous vegetation when applied heavily, but such applications make the soil sterile for several years. Thus, their usefulness is limited to situations where no crops are grown.

Sodium chlorate.—This chemical is a fire hazard due to the fact that it contains a large amount of oxygen. Sodium chlorate alone is neither inflammable nor explosive but in contact with combustible materials, such as sulphur, wood, clothing, dried plants, or dust from organic materials, it will burn vigorously when ignited or explode when struck a heavy blow. The following statements by Dr. Willard[2] of the Ohio Station emphasize the precautions that must be observed in handling sodium chlorate.

"1. Use metal containers for sodium chlorate solution if possible. If necessary to use wooden containers or spray tanks wash them out thoroughly after using and then let them stand full of pure water for several days or weeks before emptying. As far as possible, keep them moist thereafter.

[2]Willard, C. J. Killing field weeds with chlorates. Ohio Agr. Exp. Sta. Bimon. Bull. 146: 158-168, 1930.

2. Wear rubber boots when spraying. Shoes once soaked with the solution are difficult, almost impossible, to free from it.

3. Do not use matches around spray clothing that has dried out. To do this is rather less safe than striking a match to see how much gasoline is in the tank.

4. Wash thoroughly or destroy all clothing, sacks, or other cloths which have become soaked with the solution. Usually it is possible to conduct the spraying in such a way as to keep the solution off one's clothes, but it should never be allowed to dry on them.

5. Avoid spilling the dry salt or the solution on floors, walls, wagon beds, etc. Sweep up or wash off any that is spilled as soon as possible. Keeping equipment well painted reduces the danger from absorbing the solution.

6. Always store or carry sodium chlorate in tight metal or glass containers, not in cloth or paper sacks. Sodium chlorate takes up water in damp weather, so much that it may dissolve. Sacks, and floors under them, rapidly become dangerous fire hazards from absorbing the dissolved chlorate and then drying again. Several automobile fires have resulted from sodium chlorate which had sifted out of cloth sacks.

7. Keep sodium chlorate tightly covered to keep out all foreign material which might make an explosive mixture. Sulphur in any form is especially dangerous and should not be stored in the same room with sodium chlorate.

8. Keep sodium chlorate away from children as you would any other dangerous material.

9. Store sodium chlorate in a detached outbuilding, and make up solutions outdoors."

The use of this chemical is yet in the experimental stage. The results secured both by investigators and farmers have not always been in agreement. Only tentative recommendations are warranted until further experimental work has clarified the situation.

Sodium chlorate is particularly recommended for killing out patches of quack-grass and Canada thistle that are not larger than a few square rods and that, if neglected, would spread over the entire farm. The estimated cost for clearing one square rod is from 40 to 60 cents.

One pound of sodium chlorate to a gallon of water is a convenient dilution; at least 2 pounds of the chemical should be put on one square rod at the first application to insure the destruction of the majority of the plants. A compressed air hand sprayer is the best equipment for making a uniform application; a sprinkling can

may be used, although it is somewhat wasteful of material. Plants around the edge of a patch are apparently harder to kill than those in the center; so it is well to spray them very carefully.

Chlorates are most effective when applied to plants in moist soils and during humid weather. Rain does not decrease the value of the spray unless it falls immediately after application.

No general statement can yet be made as to the best time to make the initial application of a chlorate spray. Rather extensive spraying tests on perennial field weeds by Willard show that both spring and early fall applications are very effective. Spraying as the plants come into bloom has also been satisfactory. Since work is generally lighter toward the end of the season, it appears advisable to apply the first spray during midsummer or early fall. Plants not sprayed until fall should be mowed at bloom time.

A single application seldom results in complete eradication. One should expect to make several additional applications to complete the job, spraying each time a healthy crop of sprouts appears.

Sodium chlorate makes the soil sterile for a time so that crop plants fail to make normal growth. The residual effect is usually lost after a period of 6 months; at most, it does not persist longer than a year.

No cases of livestock poisoning have been reported as a result of grazing on vegetation sprayed with sodium chlorate. As a precaution, animals should be well salted before they are put in a pasture that has been recently sprayed.

According to results secured by several investigators, field garlic, common milkweed, and horse-nettle are difficult to kill with sodium chlorate, and at this time it is not recommended for these weeds.

Calcium chlorate.—This material is considerably less of a fire hazard than sodium chlorate due to the fact that it readily takes up moisture from the atmosphere.

Calcium chlorate is at present available in commercial quantities only as a patented preparation that is equivalent to about 60% calcium chlorate. Thus far under Ohio conditions, this material has not been as effective, pound for pound, as sodium chlorate. It is certainly a more satisfactory material for dealers to handle in small retail lots because of the lesser fire hazard.

Common salt.—This readily available chemical has some uses as a weed killer for small areas. It is used chiefly on walks, drives, tennis courts, and small areas of waste ground where it is desirable to prevent the growth of all vegetation. Crushed rock salt, com-

monly known as ice cream salt, is satisfactory and is the cheapest form of this material. The salt is applied in the dry form at the rate of from ½ to 1 pound to a square-foot area. This treatment makes the soil sterile for a period of from one to several years, depending on the type of soil and amount of rainfall. Somewhat quicker action can be secured during a dry season by soaking the soil with strong salt brine prepared by dissolving from 2 to 3 pounds of salt in one gallon of water.

Scattered root-crown perennials of the herbaceous type can be killed by applying a handful of salt around the base. In case the root is fleshy, it is better to spud out the crown and apply a small handful of salt to the cut surface of the root. Woody perennials of the shrub type that have a mass of feeding rootlets directly below the crown can be killed by an application of salt around the base. An application of from 10 to 15 pounds is necessary for a clump of bushes with a diameter of one foot at the base.

Sodium arsenite.—This chemical is very poisonous to both man and animals. Vegetation sprayed with it has a brackish sweet taste that is attractive to grazing animals. It should never be used where there is a possibility of livestock gaining access to it. The user must avoid inhaling the powder when that form is used for making up the solution. The solution should be kept off the hands to avoid any possibility of poisoning or burning.

Sodium arsenite is recommended chiefly for making a heavy application on small areas such as walks, drives, or tennis courts where it is desirable to destroy all vegetation and render the soil sterile.

The several grades of commercial sodium arsenite solution vary in strength. Some contain the equivalent of from 1 to 2 pounds of white arsenic to the gallon; others contain the equivalent of 8 pounds to the gallon. The latter material is usually diluted at the rate of one gallon of the solution in from 40 to 50 gallons of water. Sodium arsenite in the powdered form is made up for spraying by dissolving one pound in from 3 to 9 gallons of water.

The majority of weed killers at present sold under a trade name contain sodium arsenite as the killing agent.

Oils.—Small areas may be cleared of vegetation by a heavy application of light fuel oils, waste crankcase oil, or crude petroleum. The oil should be thinned sufficiently with kerosene so that it can be sprayed on readily. Since such materials are a fire hazard, they should not be used around buildings.

Iron sulphate.—This chemical is fairly satisfactory for the eradication of dandelion in lawns. Directions for its use are given

in the section on methods of eradication for certain noxious perennial weeds (Page 144).

Iron sulphate[3] is sometimes used to control a heavy stand of corn mustard in a grain crop. It is also effective for other mustards that do not have smooth, waxy leaves. The solution is prepared by dissolving 100 pounds of the chemical in 50 gallons of water. The application should be made on a warm, humid, clear or cloudy day when rain is unlikely for 24 hours. The application should be made while the mustards are in the three- to five-leaf stage. Injury to the grain is apt to result if spraying is delayed until it is in head. Young clover is seriously injured if sprayed during the cotyledon stage.

Copper sulphate at a dilution of from 12 to 15 pounds in 50 gallons of water may be used. Commercial sulphuric acid at a dilution of 16 pounds in 50 gallons of water is somewhat more effective than the sulphates during dry weather but has a somewhat corrosive effect on equipment, clothing, and skin.

METHODS OF ERADICATION FOR CERTAIN NOXIOUS PERENNIAL WEEDS

FIELD GARLIC

Digging with spade or mattock is recommended only for a few scattered plants or small clumps. One is very apt to miss both the aerial and hard-shelled bulblets by this method.

Spraying.—An oil spray is fairly satisfactory for small patches. Waste crankcase oil, orchard heating oil, and fuel oil are suitable but they must be thinned with kerosene to allow easy application. Waste oils should be strained to remove dirt that would clog the spraying equipment. A hand sprayer is preferable for making a uniform application; a sprinkling can is fairly satisfactory. Cover the plants thoroughly but do not saturate the soil. Apply the oil spray during the last half of April before the heads are formed, and again during late fall. The applications must be repeated during two or three seasons in order to eradicate this weed completely. The sprayer should be washed out carefully after use; oils are very injurious to rubber attachments.

Plowing and cultivation.—Cultural methods of eradication can be applied intelligently only when one understands how this weed is propagated. Field garlic is propagated chiefly by soft-shelled bulbs, by hard-shelled bulblets commonly known as "beech-nuts",

[3]Muenscher, W. C. Wild mustard and related weeds. Cornell Exten. Bull. 168, 1928.

and by aerial bulblets that somewhat resemble grains of wheat. The soft-shelled bulbs develop during late winter or spring, sprout during late summer or fall of the same season, grow during the winter except when the ground is frozen, and produce a new soft-shelled bulb, as well as several hard-shelled bulblets during late winter or spring. The plant forms a head during early May and on it are developed aerial bulblets about the time of wheat harvest. Some hard-shelled bulblets sprout during fall and grow through the winter, but the majority do not start growth until the following spring. Some of them remain dormant, sprouting irregularly during all seasons and over a period of several years. Hard-shelled bulblets also produce a crop of underground bulblets. Aerial bulblets fall to the ground and sprout during late summer or fall of the season they are produced.

During late winter and early spring new bulblets are being produced before all those of the previous season have sprouted. This overlapping of generations makes eradication especially difficult.

The following schedule of plowing and cultivation is the only efficient method known for eradicating large areas of field garlic. It is effective as well for species of wild onion. The wild onion has flattened yellowish-green leaves and does not form hard-shelled bulblets.

Fall plowing.—The object is to destroy plants from the soft-shelled bulbs, small plants from hard-shelled bulblets, and weak plants from aerial bulblets. Disc to destroy the tops, then plow fairly deep during November, preferably about the fifteenth, so that the plants are turned completely under. It is necessary to delay till this time so that plants from soft bulbs have largely exhausted their food reserves as a result of top growth and to allow as many as possible of the hard-shelled bulblets to start growth.

Spring plowing.—The object is to prevent the development of a crop of underground bulbs and bulblets, as well as to destroy plants. Plow early, preferably not later than the first of April.

Cultivation.—Plant corn and cultivate as late as possible to destroy plants from hard-shelled bulblets that sprout during all seasons. The type of shovel suggested for Canada thistle is satisfactory. Hoe out scattered plants around the corn hills.

Subsequent treatment.—Plow in the fall and repeat the plowing-cultivation schedule through the second, and, if necessary, the third season. Soybeans may be used the second season. This long

schedule is necessary to destroy plants from hard-shelled bulblets that undergo delayed germination.

Control measures.—Field garlic can be kept under control but not eradicated by the use of cultivated crops alone. Spring grains may be included in the rotation since early plowing for them is an aid in preventing the production of bulblets.

Sheep are helpful for keeping down the weed in pastures.

QUACK-GRASS

Hand methods and the use of a cover of tar paper or other light-proof materials are practicable only for small isolated patches with an area of a square rod or less.

Spraying.—A spray of sodium chlorate is satisfactory for patches with an area of a few square rods. An application during June or early July and one or two subsequent applications during late summer and fall to kill sprouts have been effective under Ohio conditions. There is some evidence that plowing during early July, followed by spraying after a month or so to kill the new growth, is equally effective and requires a smaller amount of chlorate.

Bare fallowing.—Although laborious, this is the most satisfactory method yet worked out for large areas. The purpose is to drag out part of the creeping stems and to prevent aerial growth from those that cannot be removed. It does not necessitate serious loss of use of the land when started during or after midsummer.

As a preliminary step, seed the infested field to meadow or pasture for a period of from one to two years. The underground stems grow within four to five inches of the surface in sod land. Mow or graze closely to prevent seeding and to weaken the weed.

Plow during midsummer after the removal of the hay crop. Adjust the plow to pass just beneath the mat of underground stems. A plow with a long, sloping mold-board is best for turning the desired flat, shallow furrow. Allow the underground parts to dry out for several days, and then cultivate with the spring-tooth harrow to drag the stems loose from the soil and further expose them. Use the horse rake to collect in piles, then haul off and burn. Harrow till the end of the season, as often as the weed produces an inch of green growth. Weekly cultivation is usually necessary.

A second, deeper plowing during late summer or early fall is sometimes necessary to bring up a fresh supply of underground stems when fallowing is attempted in loose soils.

The following method is sometimes used when the sod is too dry and tough during midsummer for effective plowing. Work the field with a weighted disk harrow with the blades set straight, first at right angles, then diagonally, to cut the sod into small blocks. Next, cultivate with the blades set at an angle to tear the sod loose. Continue with the disc or spring-tooth harrow to the end of the season, as previously outlined.

Fairly satisfactory results can be secured by plowing during early fall, followed by frequent harrowing until the end of the season.

Subsequent treatment of the fallowed area is important to prevent reestablishment of the grass. The common procedure is to plow in the spring and follow with a tilled crop. Hoe out scattered plants missed by the cultivator. Follow with another cultivated crop or a smother crop the next season, or a winter grain crop may follow the first tilled crop if the weed has disappeared by that time.

Another plan is to plow in the spring, fallow until summer, and plant a smother crop. A tilled crop can follow the next season. This plan is advisable if the fallow period was not started until the previous fall.

THE BINDWEEDS

Both field bindweed and hedge bindweed are propagated by seeds and creeping, underground parts. They differ in that the former is propagated by long, slender roots that produce aerial shoots, propagating roots or long, vertical, feeding roots by the growth of numerous, adventitious buds while hedge bindweed is propagated by thickened, brittle, underground stems that produce aerial shoots and roots from buds at the nodes. Hedge bindweed is the less resistant of the two weeds. In some of the western states field bindweed makes such a rank growth that farmers sometimes give up the land. However, under our conditions, either species can be kept under control or completely eradicated by cultural methods.

Hand methods.—Small, isolated patches of the bindweeds can be eradicated by keeping the shoots cut off below the ground over a period of at least two seasons. Weekly attention is necessary.

Spraying.—A spray of sodium chlorate, applied as suggested for Canada thistle, is satisfactory for areas of a few square rods.

Intertillage of crops.—The purpose of cultivation is to keep the aerial shoots cut off below the surface. At least weekly cultivation is necessary, using the type of shovel suggested for Canada thistle

wherever possible. Hoe-cutting is necessary for scattered plants, both during and after the period of cultivation. Careful cultivation of a crop through at least two seasons is usually required.

Bare fallowing.—This extreme measure is recommended under our conditions only when the stand is so heavy that a tilled crop cannot be profitably grown. The fallow period should extend throughout the season or be started, at most, not later than after the removal of a grain crop. A tilled crop should follow the next season.

Smother crops.—A good stand of alfalfa is effective once the bindweeds have been weakened by a season or more of cultivation. Annual smother crops are also helpful providing the top growth of the bindweed is kept down from spring until time to plant the crop.

CANADA THISTLE

Hand methods and covering to exclude light are of value only for small isolated patches.

Spraying.—Sodium chlorate may be applied as a spray during early bloom or the patches may be mowed during bloom and sprayed in early fall after top growth has been renewed. The latter method is applicable after the removal of a grain crop. In either case it is usually necessary to make one or two additional applications to kill sprouts.

Intertillage of crops.—The aim is to starve out the creeping roots by keeping the aerial shoots cut off. Plant corn in check rows and cultivate as often as the shoots grow to a length of 2 or 3 inches. The cultivator should be equipped with sweeps if the soil is loose enough to permit their use; otherwise, the duckfoot type of shovel is recommended. Use the hoe to remove scattered plants and to keep down growth after cultivation has ceased. Plant a cultivated crop the next season or use a good smother crop.

Bare fallowing during one season, followed by a tilled crop, is sometimes necessary for a heavy infestation.

Smother crops.—Alfalfa is probably the most effective smother crop, although biennial sweet clover and soybeans have been successfully used. Smother crops are generally used after the weed has been weakened by cultural methods, but the order may be reversed if desired, using tillage to complete the eradication of plants previously weakened by a smother crop.

Mowing.—This is the only method of practical use for large areas of badly infested permanent pasture and waste ground. Systematic close mowings at monthly intervals from the first of

June to the end of the season gave practically complete eradication when continued over a 4-year period, according to experiments by Welton and others[4]. Mowing at closer intervals doubtless would have destroyed the weed in a shorter time.

DANDELION

This root-crown perennial is readily controlled by cultural methods; hence, it is seldom a problem as a field weed. The following methods are useful for lawns where it is a troublesome invader.

Sulphate of ammonia.—The following treatment is effective according to Welton and Salter[5]. Apply evenly in the dry form at the rate of 10 to 15 pounds to 1000 square feet when the plants are wet so that it will cling to the leaves. Make the first application as the plants come into bloom and at monthly intervals throughout the remainder of the season, thus requiring four or five applications. The grass may be injured to some extent by this treatment; bare spots should be reseeded in the fall or next spring.

Iron sulphate.—This chemical is fairly satisfactory when properly used. Prepare the solution by dissolving from 1½ to 2 pounds of iron sulphate in one gallon of water. This amount should cover 300 or more square feet of lawn. Apply as a fine mist with a hand sprayer, using sufficient solution to wet thoroughly, but not drench, the foliage. The spray is most effective during humid weather but when rain is unlikely for a day. Make the first application before bloom and thereafter as often as the leaves have grown to a length of 3 or 4 inches. From three to five applications can be made during the season; two seasons' work may be necessary to complete eradication.

The grass is only temporarily darkened by the treatment, but white clover is largely killed. This spray leaves a rusty stain that is hard to remove from walks, clothing, and metal objects.

Other methods.—Scattered plants can be killed by injecting gasoline into the crown with an oiling can. Concentrated sulphuric acid applied to the crown by means of an ice pick, iron rod, or pointed stick is satisfactory providing the user exercises care to keep the acid off skin and clothing. Spudding well below the crown, supplemented by salting, is fairly effective.

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[4]Welton, F. A., Morris, V. H., and Hartzler, A. J. Organic food reserves in relation to the eradication of Canada thistles. Ohio Agr. Exp. Sta. Bull. 441, 1929.

[5]Welton, F. A. and Salter, Robt. M. Better lawns. Ohio Agr. Exp. Sta. Spec. Circ. 18, 1929.

COMMON WEED IMPURITIES OF CROP SEEDS

The use of bright, plump, weed-free, agricultural seeds of high viability is essential from the standpoint of crop production and weed prevention. It is well for the purchaser to be familiar with the various weed seeds that commonly occur as impurities in the several major crop seeds. Equipped with such information the purchaser can frequently decide after a brief examination whether the lot of seed in question is liable to be a source of weed infestation. In case of doubt, a representative sample of the crop seed should be submitted to a seed analyst for examination.

The weed seeds that are apt to occur as impurities in seeds of the small grains, common grasses, clovers, and alfalfa are listed below.

SMALL GRAINS

Bromus secalinus	Common Chess
Avena fatua	Wild Oats
Agropyron repens	Couch-grass
Chaetochloa glauca	Yellow Foxtail-grass
Thlaspi arvense	Field Penny-cress
Conringia orientalis	Hare's-ear Mustard
Barbarea barbarea	Yellow Winter-cress
Sinapis arvensis	Corn Mustard
Brassica juncea	Indian Mustard
Agrostemma githago	Corn Cockle
Chenopodium album	Lamb's-quarter
Rumex acetosella	Sheep Sorrel
Tiniaria convolvulus	Black Bindweed
Convolvulus arvensis	Field Bindweed
Lithospermum arvense	Corn Gromwell
Ambrosia trifida	Giant Ragweed
Ambrosia elatior	Roman Ragweed
Helianthus spp.	Sunflowers
Centaurea cyanus	Bachelor's-button

The aerial bulblets of **Allium vineale**, or field garlic, are apt to be an impurity in commercial wheat in sections where this weed grows in abundance.

TIMOTHY

Panicum capillare	Tumble Panic-grass
Camelina sativa	Common False-flax
Lepidium spp.	Peppergrasses
Alsine media	Common Chickweed
Especially in Canadian seed.	
Chenopodium album	Lamb's-quarter
Rumex acetosella	Sheep Sorrel
Oenothera biennis	Common Evening-primrose
Potentilla spp.	Cinquefoils
Verbascum blattaria	Moth Mullen
Plantago rugelii	Rugel's Plantain
Plantago lanceolata	Ribgrass Plantain
Rudbeckia hirta	Black-eyed-Susan
Erigeron spp.	Fleabanes

Achillea millefolium	Common Milfoil
Chrysanthemum leucanthemum	Oxeye Daisy
Cirsium arvense	Canada Thistle

The weed-seed impurities found in timothy may occur to some extent in the other small-seeded grasses. Furthermore, the impurities listed under the several clovers may be found in the grasses.

RED-TOP BENT-GRASS. RED-TOP

Potentilla monspeliensis	Rough Cinquefoil
Plantago rugelii	Rugel's Plantain
Plantago lanceolata	Ribgrass Plantain
Achillea millefolium	Common Milfoil
Chrysanthemum leucanthemum	Oxeye Daisy

KENTUCKY BLUE-GRASS

Bursa bursa-pastoris	Shepherd's-purse
Lepidium spp.	Peppergrasses
Alsine media	Common Chickweed
Cerastium vulgatum	Common Mouse-ear Chickweed
Silene spp.	Catchfly
Rumex acetosella	Sheep Sorrel
Potentilla monspeliensis	Rough Cinquefoil
Veronica arvensis	Field Speedwell
Plantago rugelii	Rugel's Plantain
Plantago lanceolata	Ribgrass Plantain
Anthemis cotula	Common Dog-fennel
Achillea millefolium	Common Milfoil
Cirsium arvense	Canada Thistle
Especially when adulterated with Canada blue-grass	
Leontodon taraxacum	Dandelion

FLAT-STEMMED BLUE-GRASS. CANADA BLUE-GRASS

Cerastium vulgatum	Common Mouse-ear Chickweed
Rumex acetosella	Sheep Sorrel
Potentilla monspeliensis	Rough Cinquefoil
Anthemis cotula	Common Dog-fennel
Cirsium arvense	Canada Thistle

Seeds of the rye-grasses, as well as other large-seeded grasses, frequently contain the seeds of **Bromus hordeaceus, Bromus secalinus,** and **Agropyron repens.** Especially is this true of imported lots of seed.

MILLETS

Syntherisma sanguinale	Large Crab-grass
Echinochloa crus-galli	Common Barnyard-grass
Chaetochloa viridis	Green Foxtail-grass
Chaetochloa glauca	Yellow Foxtail-grass
Thlaspi arvense	Field Penny-cress
Conringia orientalis	Hare's-ear Mustard
Brassica juncea	Indian Mustard

Agrostemma githago	Corn Cockle
Amaranthus spp.	Amaranths
Chenopodium album	Lamb's-quarter
Rumex acetosella	Sheep Sorrel
Persicaria persicaria	Lady's-thumb
Cannabis sativa	Hemp
Ambrosia elatior	Roman Ragweed
Bidens connata	Swamp Bur-marigold
Centaurea cyanus	Bachelor's-button

RED CLOVER

Panicum capillare	Tumble Panic-grass
Syntherisma sanguinale	Large Crab-grass
Echinochloa crus-galli	Common Barnyard-grass
Chaetochloa viridis	Green Foxtail-grass
Chaetochloa glauca	Yellow Foxtail-grass
Camelina sativa	Common False-flax
Lepidium spp.	Peppergrasses
Brassica spp.	Mustards
Chamaesyce preslii	Nodding Spurge
Sida spinosa	Prickly Sida
Silene spp.	Catchfly
Amaranthus spp.	Amaranths
Chenopodium album	Lamb's-quarter
Rumex crispus	Curled Dock
Rumex acetosella	Sheep Sorrel
Persicaria persicaria	Lady's-thumb
Melilotus spp.	Sweet-clovers
Medicago lupulina	Hop Medic
Cuscuta epithymum	Clover Dodder
Lithospermum arvense	Corn Gromwell
Verbena spp.	Vervains
Plantago rugelii	Rugel's Plantain
Plantago lanceolata	Ribgrass Plantain
Plantago aristata	Large-bracted Plantain
Daucus carota	Wild Carrot
Ambrosia elatior	Roman Ragweed
Anthemis cotula	Common Dog-fennel
Cichorium intybus	Chicory

ALSIKE CLOVER

Lepidium spp.	Peppergrasses
Bursa bursa-pastoris	Shepherd's-purse
Cerastium vulgatum	Common Mouse-ear Chickweed
Silene spp.	Catchfly
Chenopodium album	Lamb's-quarter
Rumex acetosella	Sheep Sorrel
Potentilla spp.	Cinquefoils
Medicago lupulina	Hop Medic
Nepeta cataria	Catnip
Plantago rugelii	Rugel's Plantain
Plantago major	Common Plantain
Anthemis cotula	Common Dog-fennel
Cirsium arvense	Canada Thistle

WHITE CLOVER

Syntherisma sanguinale	Large Crab-grass
Chaetochloa viridis	Green Foxtail-grass
Chaetochloa glauca	Yellow Foxtail-grass

Bursa bursa-pastoris	Shepherd's-purse
Alsine spp.	Chickweeds
Cerastium vulgatum	Common Mouse-ear Chickweed
Amaranthus spp.	Amaranths
Chenopodium album	Lamb's-quarter
Rumex acetosella	Sheep Sorrel
Polygonum aviculare	Doorweed
Potentilla monspeliensis	Rough Cinquefoil
Nepeta cataria	Catnip
Plantago rugelii	Rugel's Plantain
Plantago major	Common Plantain
Plantago lanceolata	Ribgrass Plantain
Anthemis cotula	Common Dog-fennel

CRIMSON CLOVER

Syntherisma sanguinale	Large Crab-grass
Papaver dubium	Corn Poppy
Silene spp.	Catchfly
Medicago lupulina	Hop Medic
Lithospermum arvense	Corn Gromwell
Plantago lanceolata	Ribgrass Plantain
Daucus carota	Wild Carrot
Anthemis arvensis	Field Dog-fennel
Chrysanthemum leucanthemum	Oxeye Daisy
Cirsium arvense	Canada Thistle
Centaurea cyanus	Bachelor's-button

ALFALFA

Eragrostis spp.	Love-grasses
Panicum capillare	Tumble Panic-grass
Syntherisma sanguinale	Large Crab-grass
Echinochloa crus-galli	Common Barnyard-grass
Chaetochloa viridis	Green Foxtail-grass
Chaetochloa glauca	Yellow Foxtail-grass
Malva rotundifolia	Roundleaf Mallow
Amaranthus spp.	Amaranths
Chenopodium album	Lamb's-quarter
Atriplex spp.	Oraches
Reported mostly in seed of this crop.	
Salsola pestifer	Russian-thistle
Rumex crispus	Curled Dock
Tiniaria convolvulus	Black Bindweed
Polygonum aviculare	Doorweed
Melilotus alba	White Sweet-clover
Sometimes an adulterant.	
Medicago lupulina	Hop Medic
Sometimes an adulterant.	
Cuscuta epithymum	Clover Dodder
Especially in imported seed.	
Cuscuta arvensis	Field Dodder
Especially in western seed.	
Plantago rugelii	Rugel's Plantain
Plantago lanceolata	Ribgrass Plantain
Plantago aristata	Large-bracted Plantain
Daucus carota	Wild Carrot
Ambrosia elatior	Roman Ragweed
Chrysanthemum leucanthemum	Oxeye Daisy
Centaurea spp.	Star-thistles
Cichorium intybus	Chicory
Especially in imported seed.	

It will be readily seen that the following weed impurities are of widespread occurrence in all crop seeds.

Panicum capillare	Tumble Panic-grass
Chaetochloa viridis	Green Foxtail-grass
Chaetochloa glauca	Yellow Foxtail-grass
Chenopodium album	Lamb's-quarter
Rumex acetosella	Sheep Sorrel
Plantago rugelii	Rugel's Plantain
Plantago lanceolata	Ribgrass Plantain

The seeds of plants belonging to the buckwheat, mustard, and amaranth families are also of rather general occurrence.

Both forage and agricultural seeds from the western and northwestern states are especially apt to contain seeds of the following weeds. Grain, forage, and alfalfa seed from these sections should be selected with especial care.

Avena fatua	Wild Oats
Camelina sativa	Common False-flax
Thlaspi arvense	Field Penny-cress
Norta altissima	Tall Hedge-mustard
Conringia orientalis	Hare's-ear Mustard
Salsola pestifer	Russian-thistle
Helianthus spp.	Sunflowers

AGRICULTURAL SEED LAW

To Regulate the Selling, Offering or Exposing for Sale of Agricultural Seeds

(Passages in italic indicate amendments effective July 28, 1929.)

Section 5805-1, General Code of Ohio. Section 1. The term "agricultural seeds" or "agricultural seed" as used in this act, shall be defined as brome grass, Kentucky blue grass, Canada blue grass, fescues, Italian rye grass, timothy, alfalfa, alsike clover, crimson clover, red clover, white clover, sweet clover, Canada field peas, cowpeas, soybeans, vetches, barley, corn of all kinds, oats, rye, wheat, buckwheat, flax, kaffir corn, millets, sorghum, cabbage and all other grasses, legumes, cereals and forage plants which are sold, offered or exposed for sale within this state for seeding purposes within this state.

Sec. 5805-2, G. C. Sec. 2. Every lot of agricultural seeds, as defined in section one of this act, except as herein otherwise provided, when in quantities of ten pounds or more, except in case of rape when one pound or more shall be the quantity requiring a label, shall have affixed thereto in a conspicuous place on the exterior of each container of such agricultural seeds, a plainly written or printed tag or label in the English language stating:

(a) Commonly accepted name of such agricultural seeds.

(b) The approximate percentage by weight of pure seed present, meaning the freedom of such agricultural seeds from inert matter and from other seeds distinguishable by their appearance.

(c) The approximate total percentage of weight of weed seed; the term "weed seeds" as herein used being defined as the noxious weed seeds listed in section three and all seeds not listed in section one as agricultural seeds.

(d) The name of each kind of seed or bulblets of the noxious weeds named in section three which are present singly or collectively as follows: (1) in excess of one seed or bulblet in each five grams of timothy, red top, orchard grass, Kentucky blue grass, Canada blue grass, fescues, brome grasses, perennial and Italian rye grass, crimson clover, red clover, white clover, alsike clover, sweet clover, alfalfa, and all other grasses and clovers not classified; (2) one in twenty-five grams of millet, rape, flax, and other seeds not specified in one or three of this subsection; (3) one in one hundred grams of wheat, oats, rye, barley, buckwheat, vetches, and other seeds as large or larger than wheat.

(e) The approximate percentage of germination of such agricultural seed together with the month and year such seed was tested, provided, however, *that a variation of not to exceed ten per cent shall be allowed.*

(f) The full name and address of the vendor of such agricultural seed.

(g) *All red clover and alfalfa seeds shall be labeled to show state, province or country of origin.*

Sec. 5805-3, G. C. Sec. 3. The term "noxious weeds" as used in this act shall include Canada thistle (Cirsium arvense), wild onion (Allium vineale), quack grass (Agropyron repens), dodders (Cuscuta species), plantains (Plantago species), wild carrot (Daucus carota), oxeyedaisy (Chrysanthemum leucanthemum), corn cockle (Agrostemma githago), docks (Rumex species), chicory (Cichorium intybus), and such other weeds as the Director of Agriculture, the Director of Ohio State Agricultural Experiment Station and the Dean of the College of Agriculture of Ohio State University may determine to be noxious and a menace in Ohio provided, however, that prior to the promulgation of the order defining that any weed seed or seeds are noxious within the definition of this act, a public hearing upon due notice thereof shall be given and to persons affected by such order, at which hearing such person may appear in person or by attorney, and provided further that said order determining that any weed seed or seeds shall be deemed to be noxious, shall not be effective until six months after the promulgation and publication of said order of the Director of Agriculture, the Director of the Ohio Agricultural Experiment Station and the Dean of the College of Agriculture of Ohio State University.

Sec. 5805-4, G. C. Sec. 4. Mixtures shall consist of two or more kinds of agricultural seeds which are grown together and sold, or are prepared and sold for general agricultural field purposes, each present in excess of five per cent by weight of the total mixture, when sold, offered or exposed for sale in lots of ten pounds or more such mixtures shall have affixed thereto in a conspicuous place on the exterior of the container of such mixture a plainly written or printed tag or label in the English language stating:

(a) That such seed is a mixture.

(b) The name and approximate percentage by weight of each kind of agricultural seed present in such mixtures in excess of five per cent by weight of the total mixture.

(c) The approximate percentage by weight of weed seed as defined in section two, sub-section (c) of this act.

(d) The name of each kind of seed or bulblet of the noxious weeds listed in section three which are present singly or collectively in excess of one seed or bulblet in each fifteen grams of such mixture.

(e) The approximate percentage of germination of each kind of agricultural seed present in such mixture in excess of five per cent by weight of the entire mixture, together with the month and year said seed was tested, provided, however, that this statement shall not be a basis for prosecution under this act.

(f) Full name and address of the vendor of such mixture.

Sec. 5805-5, G. C. Section 5. Special mixtures shall consist of all mixtures of agricultural seeds which are prepared and sold for special purposes, including lawn mixtures and golf mixtures. When sold, offered, or exposed for sale as mixtures in bulk, packages, or other containers of eight ounces or more special mixtures shall have affixed thereto in a conspicuous place on the exterior of the container of such mixture a plainly written tag or label in the English language stating:

(a) That such seed is a mixture.

(b) The name of each kind of agricultural seed which is present in proportion of five per cent or more of the total mixture.

(c) The approximate total percentage by weight of weed seeds as defined in section two, sub-section (c) of this act.

(d) Approximate percentage by weight of inert matter.

(e) The name of each kind of seed or bulblet of noxious weeds listed in section three of this act, which are present, singly or collectively, in excess of one seed or bulblet in each fifteen grams of such mixture.

(f) The full name and address of the vendor of such mixture.

Sec. 5805-6, G. C. Sec. 6. Agricultural seeds or mixtures of the same shall be exempt from the provisions of this act.

(a) When possessed, exposed for sale, or sold for food purposes only.

(b) When sold direct *from grower* to seed merchants *to be cleaned or graded* or shipped to a general market to be cleaned or graded before offered or exposed for sale for seeding purposes.

(c) When in store for the purpose of recleaning, or not possessed, sold, or offered for sale for seeding purposes within the state.

(d) When such seed is grown, sold and delivered by any producer on his premises for seeding purposes by the purchaser himself, unless the purchaser of said seeds demands and receives from the seller at the time of the sale a certificate that said seed is subject to the provisions of this act. If, however, said seed be advertised for sale through the medium of the public press or by circular letter or for delivery through a common carrier said producer shall be considered a vendor, and said seed must be labeled in accordance with the provisions of this act.

Sec. 5805-7, G. C. Sec. 7. The *director* of agriculture shall receive sample or samples of *agricultural* seeds *as defined by this act*, from any grower, seedman, person, firm or corporation who shall send such sample to him for examination; and said *director* shall have sample or samples of seeds examined and analyzed in conformity with the provisions of this act and the standards fixed by the regulations provided for herein. Said examination and analysis shall be made free of charge to residents of Ohio and a report submitted show-

ing the condition of the same with respect to percentage of purity together with the percentage and kind of noxious weed seeds and other impurities, as well as statement of percentage of germination, to the sender within a reasonable time after the sample is received.

Sec. 5805-8, G. C. Sec. 8. It shall be the duty of the said director, either by himself or his duly authorized agents, to inspect, examine and make analysis of and test any agricultural seeds sold, offered or exposed for sale within this state for seeding purposes within this state, at such time and place, and to such extent as he may determine. The director of agriculture, or his agents, shall have free access at all reasonable hours to any premises or structures to make examination of any such agricultural seeds, whether such seeds are upon the premises of the owner or consignee of such seeds or on the premises or in possession of any warehouse, elevator, railway or steamship company, and he is hereby given authority in person or by his agents, upon notice to the dealer, his agents or the representative of any warehouse, elevator, railway or steamship company, if present, to take for analysis sample of such agricultural seeds. Said sample shall be thoroughly mixed and two official samples taken therefrom, each official sample shall be securely sealed. One of these official samples shall be furnished to the vendor or party in interest in person, if present, and if not present shall be promptly forwarded to the shipper or owner and the other retained by the director of agriculture or agent for analysis. In case a sample drawn as provided herein upon test or analysis is found to fall below the statement on the tag or label attached to the lot from which said sample was secured, or to violate any of the provisions of this act, the vendor or consignee of said lot of seed shall be notified and a copy of said notice mailed to the person, firm or corporation whose tag or label was found affixed thereto.

Sec. 5805-9, G. C. Sec. 9. The *director* of agriculture shall enforce the provisions of this act and shall be empowered to adopt such reasonable rules and regulations as may be deemed necessary in order to secure its efficient enforcement. It shall be the duty of the *director* of agriculture to publish or cause to be published the results of *all prosecutions for violations or noncompliance with the provisions of this act*, the examinations, analyses and tests of any and all samples of agricultural seeds or mixture of such seeds drawn as provided for in section eight, together with the dates such tests were made. The *director* of agriculture is empowered to seize any seed sold in or offered for sale in Ohio which is not properly labeled and hold same until proper labeling is effected by the shipper or seller of such seed.

Sec. 5805-10, G. C. Sec. 10. The director of agriculture shall maintain a laboratory with necessary equipment, and may appoint such analysts, inspectors, and assistants as may be necessary for the enforcement of the provisions of this act. He shall fix the compensation for such analysts, inspectors, and assistants who shall be paid their actual and necessary expenses incurred when traveling in the discharge of their duties. All such expense vouchers shall be approved by the director of agriculture.

Sec. 5805-12, G. C. Sec. 12. All moneys received from license fees, fines and costs imposed and recovered under the provisions of this act, shall be paid to the director of agriculture or his agents and by him paid into the state treasury to the credit of the general revenue fund.

Sec. 5805-13, G. C. Sec. 13. For the purpose of defraying the cost of inspection and analyses of agricultural seeds under the provisions of this act it is hereby further provided that before any person, firm, company or corporation shall sell, offer for sale, expose for sale, *or solicit for sale* in this state any of the agricultural seeds, except as provided in section 6, sub-section (d) of this act, he or they shall pay each year a license fee to the *director* of agriculture of five dollars, *for each separate place of business in which seeds are offered for sale, and* shall receive from said *director* of agriculture a certificate to sell agricultural seeds until the first day of January next following.

Sec. 5805-14, G. C. Sec. 14. It shall be the duty of the director of agriculture or his representatives to bring prosecution for all violations under the provisions of this act before justice of peace, police judge, mayor or other court of competent jurisdiction.

Sec. 5805-15, G. C. Sec. 15. Every violation of the provisions of this act, relating to *the payment of license fee*, failure to label, or false labeling, shall be deemed a misdemeanor, punishable by a fine of not more than one hundred dollars. Whoever interferes with the director of agriculture, or any of his duly authorized agents, when in the discharge of the duties herein enjoined, or refuses such persons the privilege of entering any room, building or other place where the seeds herein named are kept for sale for seeding purposes, within this state, shall be guilty of a misdemeanor, and upon conviction shall be fined not less than five dollars nor more than one hundred dollars, and shall pay the cost of prosecution.

OHIO WEED LAW

Sections of the General Code Relating to Destruction of Canada Thistles or Russian Thistles, Wild Parsnip, Wild Carrot, Oxeye Daisy, or Wild Mustard

Be it enacted by the General Assembly of the State of Ohio:

7153 of the General Code be re-enacted to read as follows:

Sec. 7146. Township trustees or street commissioners having control of and being charged with the duty of repairing macadamized, graveled or improved roads and turnpikes, and road superintendents of county and township roads and the street commissioners of each city or village, between the first and twentieth days of June, and between the first and twentieth days of August, and, if necessary, between the first and twentieth days of September of each year, shall destroy or cause it to be done, all brush, briars, burrs, vines, Russian and Canadian or common thistles, or other noxious weeds, growing or being within the limits of a county or township road, turnpike, improved, graveled or macadamized road, street, or alley within their jurisdiction.

Sec. 7150. Upon written information that Canada or Russian thistles, wild carrots, oxeye daisy or wild mustard are growing on lands in a township, and are about to spread or mature seeds, the trustees of the township shall cause a written notice to be served upon the owner, lessee, agent or tenant having charge of such land notifying him that said noxious weeds are growing on such lands and that they must be cut and destroyed within five days after service of such notice.

Sec. 7151. A constable or a marshal of a city or village, or his deputy, may make service and return of the notice provided for in the next preceding section and the fees therefor shall be the same as are allowed for service and return of summons in civil cases before a magistrate.

Sec. 7152. If the owner, lessee, agent or tenant having charge of the lands mentioned in the section seventy-one hundred and fifty, fails to comply with such notice, the township trustees shall cause said noxious weeds to be cut and destroyed and may employ the necessary labor to carry out the provisions of this section. All expenses incurred shall, when approved by the township trustees, be paid out of any money in the treasury of the township not otherwise appropriated.

Sec. 7153. The township trustees shall make a written return to the board of commissioners of their county of their action under the next three preceding sections with a statement of the charges for their services, the amount paid for the performing of such labor and the fees of the officers who made the service of the notice and return and a proper description of the premises. Such amounts, when allowed, shall be entered upon the tax duplicate and be a lien upon such lands from and after the date of the entry and be collected as other taxes and returned to the township with the general fund.

GLOSSARY

Achene—A one-seeded, dry, indehiscent fruit with a tightly fitting covering around the seed.
Acuminate—Tapering gradually to the apex.
Acute—Sharp-pointed.
Alternate—With a single leaf or other organ at each node.
Annual—Yearly; living but one year.
Apetalous—Without petals.
Appressed—Lying close against another organ.
Ascending—Growing obliquely upward.
Attenuate—Narrowed, tapered.
Auricled—With ear-like lobes or appendages.
Awn—A slender, bristle-like organ.
Axil—The point of a stem just above the base of the leaf.
Biennial—Lasting 2 years.
Bisporangiate—Having both stamens and carpels.
Bipinnate—Twice pinnately compound.
Biternate—Twice ternate.
Blade—The expanded part of a leaf.
Bract—A small, rudimentary, or imperfectly developed leaf.
Bulb—A bud with fleshy bracts or scales, usually subterranean.
Bulblet—A small bulb, especially on leaves, or in their axils.
Bulbous—Similar to a bulb; bearing bulbs.
Calyx—The outer set of sterile, floral leaves; the whole set of sepals.
Campanulate—Bell-shaped.
Canescent—With gray or hoary, fine pubescence.
Capitate—Arranged in a head.
Capsule—A dry fruit of two or more carpels, usually dehiscent by valves or teeth.
Carpel—The modified leaf bearing the ovules.
Carpellate—Having only carpels or carpellate flowers.
Chlorophyll—The green coloring matter of plants.
Ciliate—Provided with marginal hairs; having cilia.
Ciliolate—Minutely ciliate.
Cleft—Divided almost to the middle.
Compound—Composed of several parts or divisions.
Cordate—Heart-shaped.
Corolla—The inner set of sterile, usually colored, floral leaves; the whole set of petals.
Crenate—With roundish teeth.
Crenulate—Minutely crenate.
Crisped—Curled or twisted.
Cuneate—Wedge-shaped.
Cuspidate—With a sharp, stiff point.
Cyme—A convex or flat flower cluster of the determinate type, the central flowers first unfolding.
Cymose—Having cymes; or like cymes.
Deciduous—Falling away at the end of the growing period.
Decompound—Several times compounded or divided, as in leaves of carrot.
Decumbent—With an inclined position but the end ascending.
Decurrent—Applied to an organ extending along the sides of another.
Dentate—With outwardly projecting teeth.
Denticulate—Finely toothed.
Diaphragm—A septum, or transverse plate, in the pith or other parts.
Diecious—Having the microsporangiate, or staminate flowers, and the megasporangiate, or carpellate flowers, on separate plants.
Diffuse—Loosely spreading.
Digitate—Diverging like the spread fingers.
Disk—A flattened enlargement of the receptacle of a flower or inflorescence; the head of tubular flowers in the sun-flowers and related plants.
Dissected—Divided into many segments.

Divided—Cleft to the base or to the midrib.
Dorsal—On the back or pertaining to the back.
Drupe—A fruit with a fleshy or pulpy outer part and a bone-like inner one.
Elliptic—With the outline of an ellipse; oval.
Emarginate—With a notched apex.
Empty glumes—The two glumes at the base of a grass spikelet.
Entire—Without teeth, serrations, or lobes.
Excurrent—With a tip projecting beyond the main part of the organ.
Fascicled—Densely clustered.
Fertile—Bearing spores, gametes, or seeds.
Fetid—Ill-smelling.
Floccose—With loose tufts of wool-like hairs.
Flowering glume—One of the two glumes inclosing a grass flower.
Fringed—Margined with hair-like appendages.
Glabrate—Nearly without hairs.
Glabrous—Without hairs.
Gland—A group of secreting cells, or a secreting hair.
Glandular—With glands, or gland-like.
Glaucous—Covered with a bluish or white bloom.
Glomerate—In a close or compact cluster.
Glume—The scaly bracts of the flowers and spikelets of grasses and sedges.
Glutinous—Sticky or gummy.
Hastate—Arrow-shaped with the basal lobes diverging.
Head—A dense, round inflorescence of sessile or nearly sessile flowers.
Hirsute—Having rather coarse, stiff hairs.
Hispid—With bristly stiff hairs.
Hyaline—Clear and translucent.
Incised—Cut into sharp lobes.
Indehiscent—Not opening.
Indurated—Hardened.
Inequilateral—With unequal sides.
Inflorescence—The flower cluster of a plant and its mode of arrangement.
Involucre—A whorl of bracts subtending a flower or flower cluster.
Keel—A projecting ridge.
Lacerate—Torn, or irregularly cleft.
Laciniate—Cut into narrow segments or lobes.
Lanceolate—Lance-shaped.
Leaflet—One of the divisions of a compound leaf.
Leaf sheath—The lower part of a leaf, which envelops the stem.
Lemma—The outer of the two flowering glumes inclosing a grass flower.
Lenticular—Lens-shaped.
Linear—A long and narrow organ with the sides nearly parallel.
Lobed—Divided to about the middle, or less.
Lyrate—Pinnatifid with the terminal lobe the largest.
Membranous—Thin and rather soft and pliable.
Midrib—The central rib of a leaf or other organ.
Mucronate—With a sharp, abrupt point.
Mucronulate—Slightly mucronate.
Nerve—A simple or unbranched vein or slender rib.
Node—The place where two internodes join, normally with a single leaf or more.
Obcordate—Inversely heart-shaped.
Oblanceolate—Inversely lanceolate.
Oblong—Somewhat longer than broad with the sides nearly parallel.
Obovate—Inversely ovate.
Obtuse—Blunt, or rounded.
Ocrea—A thin, sheathing stipule or united pair of stipules.
Orbicular—Nearly circular in outline.
Ovate—Shaped like the longitudinal section of a hen's egg.
Ovulary—The ovule-bearing part of a closed carpel or set of carpels.
Palet—The inner of the two glumes inclosing the flower of a grass.
Palmate—Diverging like the fingers of a hand.

Panicle—A compound inflorescence of the racemose type, usually of pyramidal form.
Paniculate—Borne in panicles or resembling a panicle.
Parasitic—Growing upon other living plants or animals and absorbing their juices and tissues as food.
Parted—Deeply cleft.
Parthenogenetic—Developing without fertilization.
Pectinate—Comb-like. Pinnatifid with narrow segments set close like the teeth of a comb.
Pedately—Palmately divided or parted with the lateral divisions 2-cleft.
Pedicel—The stalk of a flower in a flower-cluster.
Peduncle—The stalk of a flower or flower-cluster.
Perennial—Growing for many years.
Perfect—A flower having both stamens and carpels.
Perfoliate—Leaves so clasping the stem as to appear as if pierced by it.
Persistent—Remaining attached after the growing period.
Petal—One of the leaves of the corolla.
Petiole—The stalk of a leaf.
Pinnate—Leaves divided into leaflets or segments along a common axis.
Pinnatifid—Pinnately cleft to the middle or beyond.
Pome—A fruit with a fleshy disk around the ovulary, as in the apple.
Prickle—A stiff, sharp-pointed outgrowth from the epidermis.
Procumbent—Lying on the ground.
Puberulent—With very short hairs.
Pubescent—Hairy, especially with fine and soft hairs.
Punctate—With translucent dots or glands.
Raceme—An elongated inflorescence with each flower on a pedicel.
Racemose—Like a raceme, or in a raceme.
Rachis—The axis of a compound leaf, spike, or raceme.
Ray—A marginal, strap-shaped corolla, as in the sunflower.
Receptacle—The end of the flower stalk bearing the floral organs.
Reniform—Kidney-shaped.
Repand—With a more or less wavy margin.
Retrorse—Directed downward or backward.
Rhizome—An underground stem.
Rosette—A cluster of leaves or other organs in a circular form.
Rudimentary organ—An imperfectly developed organ; or one that has become reduced either in the history of the race or of the individual.
Sagittate—Shaped like an arrow-head.
Scabrous—Rough.
Scale—A highly modified, dry leaf, as in a winter bud; also the fleshy leaf bases or leaves of a bulb; a flat, more or less membranous outgrowth from a leaf or stem.
Scape—A leafless or nearly leafless stem, coming from an underground part and bearing a flower or flower cluster.
Scapose—Having scapes or resembling scapes.
Scurfy—Covered with scurf; minute, membranous scales, as in Chenopodium.
Segment—A division of a compound leaf or of a perianth.
Sepal—One of the leaves of a calyx.
Serrate—With teeth projecting forward.
Serrulate—Finely serrate.
Sessile—Without a stalk.
Sinuate—With strongly wavy margins.
Spatulate—Widened at the top like a spatula.
Spike—An elongated inflorescence with sessile or nearly sessile flowers.
Spikelet—A small spike; especially the ultimate flower-cluster of the inflorescence of grasses and sedges.
Spine—A short, thorn-like organ representing a leaf or part of a leaf in origin, as the spines on the leaves of the Christmas holly.
Spinose—With spines or similar to spines.
Spinulose—With small, sharp spines.

Spreading—Diverging and nearly prostrate.
Stamen—The organ of a flower which produces pollen grains.
Staminate—Having only stamens or staminate flowers.
Stellate—Star-shaped.
Stigma—The upper part of the carpel; a special organ of the Angiosperms to catch the pollen grains.
Stipular scar—The mark made on the bark by deciduous stipules.
Stipules—Bract-like appendages at the base of the petiole of many leaves.
Stolon—A basal branch rooting at the nodes.
Stoloniferous—Bearing stolons.
Striate—Marked with fine, longitudinal, parallel lines, as grooves or ridges.
Strigose—With stiff, appressed or ascending hairs.
Style—The narrow top of the carpel or united carpels between the ovulary and stigma.
Subulate—Awl-shaped.
Succulent—Soft and juicy.
Tendril—A slender, coiling organ.
Ternate—Divided into three segments; arranged in threes.
Thorn—A highly modified, sharp-pointed branch.
Tomentose—Covered with dense, wool-like hairs.
Toothed—Dentate.
Trifoliate—A compound leaf with three leaflets.
Trilocular (3-locular)—With three cavities.
Truncate—Terminating abruptly by a nearly straight edge or surface.
Tuber—A thick, short, geophilous branch or part of a branch.
Tubercle—A small tuber or a wart-like projection; the persistent base of the style in some sedges.
Two-ranked—Disposed in two vertical rows along the twig; with the third leaf in line with the first.
Undulate—With wavy margins.
Urceolate—Urn-shaped.
Vascular bundle—The conducting strands in the plant body composed of wood and bast in which water and food materials are conducted through the roots, stem, and leaves, or other organs.
Vein—One of the branches of the vascular portion of leaves or other organs.
Verticillate—Whorled.
Villous—With long, soft hairs not matted together.
Viscid—Sticky from a tenacious coating or secretion.
Whorled—A group of three or more similar organs radiating from a node.
Winged—With a thin expansion.

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Valid names in bold face; synonyms in italics; †—illustration